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The Orme Pop Safety Valves.

The accompanying engraving, Fig. 1, shows a sectional view of the Orme locomotive pop safety valve, as made by the Union Brass Mfg. Co., 103 East Ohio street, Chicago, Ill. New York office, 115 Broadway. One of the principal features of this valve is the construction of the equalizing bar and spindle, by which all inequalities in the spring are overcome. The pressure is pivoted near the top of the spring and the bottom of the valve, thus preventing all friction and liability of the valve to cock or tilt. This valve, therefore, will rise instantly when the pressure reaches the lifting point. In consequence of this arrangement, an even pressure upon the valve-seat is secured; consequently there can be no leakage or cutting of seats. This engraving also shows the adjustable angular face, by means of which the valve can be adjusted to blow off at any desired pressure of steam, reducing the pressure rapidly, and closing with the smallest possible loss of pressure.

Engraving, Fig. 2 is the same valve in principle as that just described, but was designed for attachment to the heads of cylinders or pumps that are subject to water pressure. The piston rings and other parts of many valuable engines have been injured in a moment to the extent of hundreds of dollars, for the want of a small relief valve for this purpose. The sensitive adjustment of this valve renders it extremely valuable for this and similar adaptations.

Engraving, Fig. 3 is also a relief and safety valve for boilers, and is likewise adapted for pumps used for water works. It also possesses all the features of the two previous valves, including this special feature, that there are *two adjustments*, one set, say, at 40 lbs., and the other at 200 lbs., or any maximum pressure that may be determined upon. The valve can be changed in a moment to blow off at either of these pressures, or at any intermediate pressures. In mills requiring a lower pressure of steam during the night than that carried during the day, this valve has important advantages, it being instantly adjustable.

Like all valves manufactured under the "Orme patents," it can be locked in a moment, and, when so adjusted, will not admit of a higher pressure being carried than that which it is adjusted to carry, until again set to some other desired pressure.

Engraving, Fig. 4 represents the Orme marine safety valve, designed for the use of seagoing vessels. It has been adopted by the U. S. Board of Supervising Inspectors of Steam Vessels, as a valve which fills the Government requirements. This valve possesses features especially worthy of the study of all those interested in steam boiler appliances.

An International Exhibition of Railway Safety Appliances is to take place this year at Paris. It will include the various systems of permanent way with iron longitudinal and transverse sleepers; next, the various descriptions of rolling stock, locomotives and carriages, so far as they have been specially designed with a view of ensuring greater safety; finally, the different appliances and apparatus serving the same end—namely, automatic and safety couplings, signalling and switching apparatus, intercommunicating signals, and continuous brakes.

FIG. 1.—LOCOMOTIVE VALVE.

FIG. 2.—RELIEF VALVE.

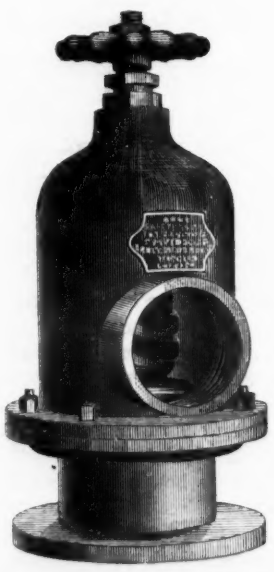


FIG. 3.—ADJUSTABLE RELIEF VALVE.

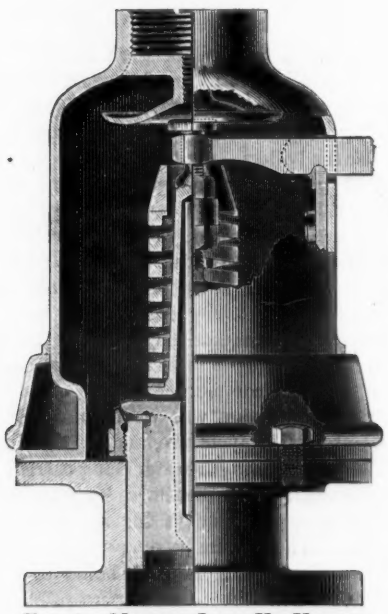


FIG. 4.—MARINE LOCK-UP VALVE.

Pounding in Steam Engines.

In visiting an engine room, the practical engineer, upon stepping within the door, casts his eyes about him to be sure that all is safe, then quietly listens for thumps. In the majority of instances it is not necessary to wait long before his quick ear detects the sound, which is always among the most disagreeable of all sounds to the sensitive engineer. A search is made for the cause of the thump. It is very soon discovered that the trouble is with the pillow-block, and by close measurement the shaft is found to jump all the way from $\frac{1}{32}$ to $\frac{1}{16}$ of an inch at each revolution, depending upon the amount of load upon the engine.

The engineer in charge will generally notice any inquisitive movements in his engine room, and will advance the assertion that he has been working for about a month to stop that pound, but has been unsuccessful, from the fact that every time he set up the quarter brasses the bearing would get so hot that he had to shut down to cool it off. There is something radically wrong with pillow-blocks and other parts of steam engines, when they fail to run without pounding when set up tight enough to prevent lost motion. In some instances the cap or upper part of the bearing, when tightened, will pinch the quarter boxes so that they cannot be moved, while in other cases these boxes are so loose that they are continually on the move. It seems to be a sort of general impression among engineers that a pillow-block ought to be run loose. This is a great injury to new engines, for it does not take long to knock the shaft all out of shape, into a condition in which it can never run without pounding. Pillow-blocks ought to run as quietly as other parts, and there is a good chance for engineers to display their skill in successfully removing these difficulties. A quiet-running engine is the pride of every engineer, and in almost all of the steam engines this result can be attained by a little perseverance. When a pound first appears in an engine, the engineer should use his skill to find out the cause, and remove it at once; otherwise the disease will become chronic, and will require more severe remedies to cure than if attended to at first.

Forced vs. Natural Draught.

The question of the relative economy of burning fuel with natural or forced blast being always interesting to steam users, the following reports of tests made at the last session of the American Institute Fair, showing the different results obtained with varying qualities of fuel when burned with natural or forced draughts, are submitted:

In making the forced-blast tests, capacity only was aimed at, but a much higher rate of economy would have been obtained, with the same increase in capacity, if the amount of grate-surface had been cut down at least 30 per cent., burning the same amount of fuel on a reduced area. A less amount of air in excess of that required for combustion would have been furnished, and a consequent higher furnace temperature attained. This point of reducing the grate area in proportion to the intensity of the draught, and burning more coal per square foot of grate when using forced blast, does not seem to be thoroughly understood by steam users. Equal and, in many cases, better economy is obtainable by using forced instead of natural draught.

From chemical analysis made of escaping gases from a large number of stacks where natural draught was used, it was found that from 40 to 70 per cent. of air in excess of the amount needed for perfect combustion is passed through the fuel, making a loss easily estimated by taking the proportion this excess bears to the total volume of the escaping gases at their temperature; and this is not all, for by admitting this large excess of air into the furnace its temperature is lowered, and as the rapidity of transfer of heat through the surfaces is directly as their differences of temperature inside and out, it will be seen that the same amount of surface is much less efficient.

On the other hand, from extended and accurate experiments made on a set of boilers at a Jersey City sugar refinery, burning coal with a forced draught at a rate varying all the way from 7 to 40 pounds of coal per square foot of grate surface per hour, it was found possible to control the amount of air and obtain practically perfect combustion with an excess of only 15 per cent. Add to this that the rate of combustion can at will

be increased or decreased to suit the varying requirements for steam, or regulated automatically by means of a damper regulator and the boiler pressure, thus avoiding waste of steam from safety-valves or loss of time from lack of pressure, it will be seen that a controlled air supply has many points in its favor.

The Loiseau compressed fuel, used in tests Nos. 1 and 2, was made of anthracite culm, pressed into lumps about the size and shape of an egg.

The chestnut coal, used in tests Nos. 3 and 4, was of an inferior quality (25 per cent. ash) to that used in test No. 5. It is a matter of regret that this difference was not definitely shown; but as test No. 5 was made to establish the fact that the boilers would work up to their rated horse-power under actual conditions, it was not thought necessary to take into account the per cent. of ash contained in the fuel.

COMPARATIVE TEST NO. 1. BY JAMES E. DENTON, M. E.

Coal—Loiseau compressed fuel.

	1882. Oct. 25th. No. 1. Natural draught.	Oct. 26th. No. 2. Forced blast, Sturtevant blower.	
Duration of test.	9	9	hours.
Average steam pressure	85	92	lbs.
Average temperature of feed..	160	165	deg.
Water evaporated	84,903	111,098	lbs.
Coal fired.....	10,968	15,855	lbs.
Per cent. of ash	15	15	per ct.
Combustible ...	9,281	13,479.5	lbs.
Grate-surface...	70	70	sq. ft.
Coal consumed per sq. ft. of grate per hour	17.4	25.17	lbs.
Water evaporated per lb. coal, under actual conditions	7.74	7.00	lbs.
Water evaporated per lb. of combustible, under actual conditions....	9.14	8.20	lbs.
Water evaporated per lb. coal, from and at 212 degrees	8.35	8.10	lbs.
Water evaporated per lb, of combustible, from and at 212 degrees...	9.87	8.90	lbs.
Rated H. P.....	250	250	H. P.
H. P. developed	330	450	H. P.
Per cent. above rated capacity	32	80	per ct.

COMPARATIVE TEST NO 2. BY JAMES E. DENTON, M. E.

Coal—Anthracite chestnut.

	1882. Nov. 3d. No. 3. Natural draught.	Nov. 4th. No. 4. Forced blast. Sturtevant blower.	
Duration of test.	8.25	7	hours.
Average steam pressure	75	85	lbs.
Average temperature of feed..	153	160	deg.
Water evaporated	50,623	72,580	lbs.
Coal fired.....	6,830.5	11,800	lbs.
Per cent. of ash	25.5	26	per ct.
Combustible....	5,096.5	8,700	lbs.
Grate-surface...	70	70	sq ft.
Coal consumed per sq. ft. of grate per hour	11.83	22	lbs.
Water evaporated per lb. coal, under actual conditions	7.40	6.14	lbs.
Water evaporated per lb. of combustible, under actual conditions....	9.93	8.30	lbs.
Water evaporated per lb. coal, from and at 212 degrees	7.56	6.69	lbs.
Water evaporated per lb. combustible, from and at 212 degrees...	10.87	9.04	lbs.
Rated H P.....	250	250	H. P.
H. P. developed	219	356	H. P.
Per cent. below rated capacity	12.4 per cent.		
Per cent. above rated capacity		48.3	per ct.

EVAPORATIVE TEST.

New York, Jan. 20, 1883.

Benj. R. Western, Esq., Chairman of Committee, Am. Institute Fair:

Sir,—In accordance with your instructions, we have made an evaporative test of the Babcock & Wilcox boilers now in the American Institute building.

Upon examination of the premises, we found that there were no proper facilities for making the test, and, therefore, had to make the needful preparations, which were to clean the boilers and furnaces and flues thoroughly; cement up all cracks in the masonry; setting of the boilers; prepare two weighing tanks and scales, for weighing the water as fed to the boilers, and a scale for weighing the coal as delivered to the boilers.

The water supplied was taken from the Croton, and, from frequent trials by the thermometer, was found at no time to differ but a small fraction from 36 degrees Fahr. We have, therefore, taken 36 degrees as the temperature of the water supplied to the boilers. The water was fed to the boilers by a steam pump (after weighing), hence was sent into the boilers without any change of temperature.

The coal used was No. 1 chestnut, of fair quality, supplied from a neighboring coal yard, and was not selected, or even examined by us until delivered at the building.

Two firemen only were employed during the whole test of 15 hours. They were evidently experienced firemen, and the firing was done well throughout the test. The test was commenced at 2:40 P. M. on January 13, and terminated at 5:40 A. M. on January 14, a period of 15 hours.

On the day previous to commencing the test (Jan. 12) the boilers were filled, steam raised, and apparatus for the work tried, to see that all was in proper condition, and during the night banked fires were kept under the boilers. On the morning of January 13 the boilers were again fired up, and a short time previous to commencing the test the fires were thoroughly cleaned and leveled off, and brought to active condition, and the height of water noted when the test was commenced. At the close of the test the water was at the same height in the boilers, and the fires judged to be in the same condition, as at the commencement.

The evaporation was under atmospheric pressure and temperature, and, to avoid any error from priming or water being carried off mechanically with the steam, large tanks of wood were constructed for the escape of steam. There were two openings of five inches diameter from each boiler to these tanks, so that there was no perceptible current. Provision was made to carry from the wood trunks any water condensation through a drip pipe, so that none should be returned to the boilers to be evaporated a second time, and the very slight drip from this pipe (mere drops) was conclusive evidence that boilers were giving off essentially "dry" steam. As respects the evaporative power of the boilers, the following is the observed data:

Temperature of feed water....	36° Fahr.
" " evaporation...	From and at 212 degrees.
Total quantity of coal consumed in the 15 hours.....	16,509 lbs.
Total quantity of water evaporated in 15 hours from 36 degrees Fahr	123,146 "
Grate surface of the two boilers.....	70 sq. ft.
Heating surface of the two boilers.....	2,807 "

From this follows that the evaporation per hour, $\frac{123146}{15}$, was 8,209.8 lbs. from 36 degrees Fahr., or 9,710.5 lbs. from and at 212 degrees Fahr.

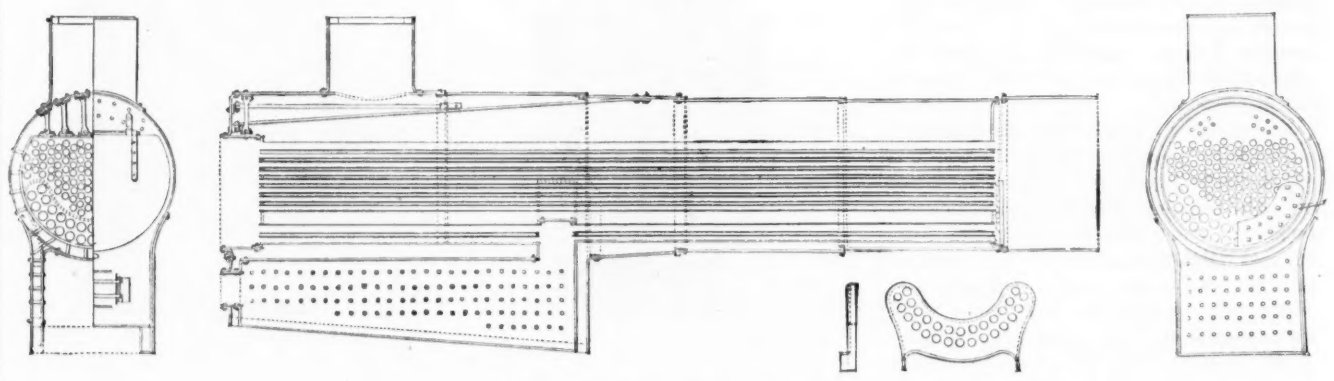
The generally accepted unit for one horse power is the evaporation of 30 lbs. of water per hour, from and at 212 degrees Fahr. Accepting this unit, the power of these boilers would be $\frac{9710 \cdot 5}{30}$=323.68 horses; but taking the unit as 30 lbs. evaporated per hour from the temperature of the feed water (in this case 36 degrees Fahr.), the power would then be $\frac{8209 \cdot 8}{30}$=273.66 horse power.

The evaporative power of the boilers was what we were directed to ascertain; but, in addition, the following will show the economy of evaporation under the existing conditions: The total amount of coal consumed in the 15 hours was 16,509 lbs., and weight of water evaporated from 36 degrees Fahr. by one pound of coal = $\frac{123146}{16509}$=7.46 lbs., and the evaporation from and at 212 degrees 8.82 lbs. for 1 lb. of coal. The weight of coal consumed per hour was $\frac{16509}{15}$ = 1100.6 lbs., or $\frac{1100 \cdot 6}{70}$=15.72 lbs. per square foot of grate, and $\frac{1100 \cdot 6}{2807}$=.392 per square foot of heating surface.

In this statement of coal consumption no deduction whatever has been made for ashes or clinkers, but the total weight of coal thrown into the furnaces is charged.

Very respectfully,

(Signed) Chas. W. Copeland.
Richard H. Buel.



Improved Locomotive Boiler.

Improved Locomotive Boiler.

The accompanying engraving represents a locomotive boiler not differing in outward appearance from the style of boiler in ordinary use. The principal point of change is the introduction of a cylindrical shell the entire length of the boiler. The bottom of the shell over the grates forms the crown sheet of the furnace, and does away with the flat crown sheet and crown bars. This crown sheet, having a downward deflection, and being a part of the cylinder forming the shell, is evidently stronger than any flat surface can be made, no matter how strongly it may be stayed.

At the rear end of the furnace is a combustion chamber let into the shell of the boiler. This chamber has a downward deflected crown sheet of less radius than the shell, to insure strength. From this combustion chamber three-inch tubes run both ways. One set of tubes return over the crown sheet to the back combustion chamber, from which two-inch tubes connect with the front of boiler or smoke box. The other three-inch tubes connect the central or first-mentioned combustion chamber with the smoke box, and are provided with a damper or plugs operated by a lever in the cab, by which the amount of fire passing through them is controlled, the object being to allow only enough flame to pass through to utilize the heating surface. The long tubes are supported near the center by a skeleton head.

The only parts of this boiler requiring flat stays are the heads or end sheets, and upper part of the back combustion chamber.

The crown sheet can be easily cleaned from a hand-hole plate in the furnace end of the boiler; and, as there are no stays, there is nothing to prevent an easy examination of the crown sheet. There are water spaces on both sides and at front and rear ends of furnace, and by means of perforations in the shell between the junction of the crown sheet and outside sheet with same, a perfect circulation is secured around the fire-box and over the crown sheet.

A boiler of this style, compared with a boiler of the ordinary kind—dimensions of both 24 feet long and 50-inch shell—shows 1,750 square feet of heating surface against 1,430 square feet in the ordinary boiler.

This boiler has not as yet been tested on a locomotive, but two boilers rated at 40-horse power, built after this plan, are in use for saw-mill purposes, and have, we are informed, proved entirely successful. One of these boilers was subjected to a hydrostatic test of 220 lbs. to the square inch, without showing any signs of weakness.

The points of superiority over the ordinary boiler claimed for this invention are: Less cost of construction, greater strength of boiler, greater amount of heating surface, more perfect combustion and economy of fuel, and less cost of repairs.

This boiler represents the inventions of Patrick Fitzgibbons, Oswego, N. Y.

A correspondent writes us as follows:

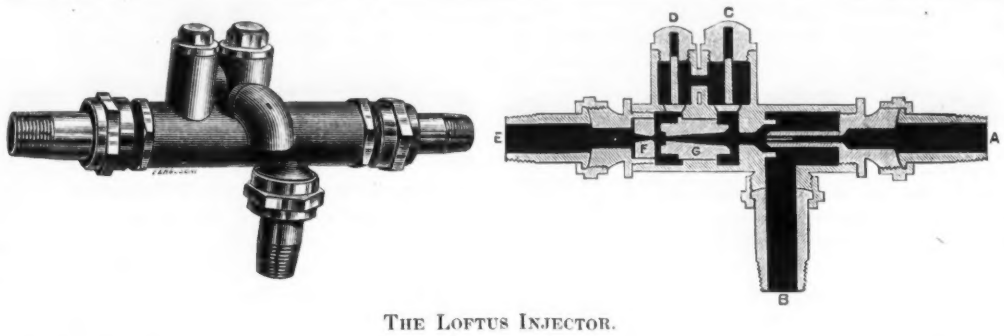
"One of the most crude devices in use about the steam boiler is the ordinary ball and lever safety valve. It is a misnomer to call it a safety valve, for the simple reason that it cannot rise to any appreciable distance from its seat, but as the pressure accumulates in the boiler it has been found by actual test to rise according to a fixed law. With an apparatus constructed expressly for the purpose of measurement, it was found that a 4-inch valve would rise from its seat according to the following pressures, *e. g.*, for

12 lbs.	20 lbs.	35 lbs.	50 lbs.
$\frac{1}{36}$	$\frac{1}{48}$	$\frac{1}{54}$	$\frac{1}{65}$
60 lbs.	70 lbs.	80 lbs.	90 lbs.
$\frac{1}{80}$	$\frac{1}{103}$	$\frac{1}{132}$	$\frac{1}{163}$

inch respectively; or, taking the average of values, the pressure from 10 lbs. to 40 lbs. the rise is $\frac{1}{40}$ of an inch, from 40 lbs. to 70 lbs. $\frac{1}{80}$, and from 70 lbs. to 90 lbs. $\frac{1}{120}$ of an inch, thus showing conclusively that the higher the pressure of steam the less capable is the valve of relieving the boiler of its pressure. All the steam, at a pressure of 75 lbs., that a tubular boiler of 500 square feet of heating surface is likely to produce, can be discharged through an opening .59 of a square inch area, which would be equal to an opening $\frac{7}{8}$ inch in diameter. Now a valve blowing off steam at about 75 lbs. per square inch will not rise over $\frac{1}{120}$ part of an inch from its seat; therefore the diameter of an ordinary safety valve to relieve this size of boiler would have to be 26.5 inches."

Mr. Ellithorpe of Chicago, has been collecting statistics with reference to elevators. The conclusion reached is that there are 45,000 in use in the United States, of which 15,000 are in New York City. On the basis of riding one mile, conveyance in an elevator is forty times more dangerous than by rail. The most fruitful source of danger, he says, is the employment of boys and irresponsible persons to run them.

The "Loftus" Injector.



The Loftus Injector.

In our issue of December 3, 1881, we illustrated the "Loftus" injector for boiler feed, which was at that time just being brought into use.

The present engravings represent recent improvements in this injector, the two figures showing it in elevation and section. As previously constructed, the body was made in three sections, while as here shown it is made in one piece, the arrangement being such that the regulating parts can be readily come at for removing dirt, or for renewal if necessary.

One important improvement in the actuating parts of this injector is in providing the steam nozzle with lateral passages or slots, opening outwardly into a surrounding water chamber. These slots, shown in white in the steam nozzle *A*, are in number from four upwards, according to the size of the steam nozzle, their object being to automatically regulate the quantity of water delivered to the injector to correspond with the fluctuations of steam pressure, so that when started the injector will continue to work notwithstanding these fluctuations. This they accomplish as follows: The steam passing under pressure through the nozzle, when it reaches the slotted section expands, and a portion of it escapes laterally and at an angle through the slots, and, acting upon the water in the surrounding chamber, forces it into the body of the injector. When the steam pressure is low, a small amount of steam only will escape through the lateral passages, and the quantity of water forced into the injector will be correspondingly small. As the steam pressure rises, the amount of steam thus escaping will be increased, forcing into the injector the increased amount of water required by the higher pressure.

The ample cylindrical chamber of suction tube surrounding the slotted part of steam nozzle furnishes a free passage for the water acted upon by the escaping steam. This water, reaching the beveled portion of the tube, is gradually concentrated towards the center, where it is brought into contact with the central steam jet.

Another new feature is connecting the chambers *D* and *C*, so that but one overflow is required instead of two, as in the original construction.

These injectors are manufactured by Peter Kinnear, Albany, N. Y.

Shop Kinks.

No. 42.

By Lewis F. Lyne.

Eccentrics and methods of holding them.

In an editorial published in the American Machinist of March 17, 1881, some of the disadvantages of the eccentric upon locomotives were described.

I am impressed with the idea that this subject ought to receive the earnest and thoughtful attention of every railway master mechanic and those having charge of locomotives. It was argued that eccentrics were round only when taken from a lathe, then by the aid of two or three set screws and a key they were distorted into the shape of a cam. Or, in other words, the eccentric touched the strap only upon two opposite sides. As a remedy for this evil it was suggested that the eccentric instead of having keys and set screws be bolted fast to a flange secured to the axle by means of a key and set screws. This method of holding eccentrics is shown in the accompanying cut, Fig. 1, which is drawn to a scale of 1½ inch to the foot. *J*, *K* represents a cast-iron collar, having a good, thick hub *B*, bored to fit neatly upon the axle *A*, *E*. *C* shows the eccentric bolted fast to the flange of this collar by means of the bolts *D*, *D*, *D*, having counterbored heads. These heads have steady pins to prevent them from turning in tightening the nuts. Before the wheels are placed under the engine the four flanges, with their eccentrics, are made fast upon the axles by keys and set screws, as shown in Fig. 1, where *G* represents the key and *F*, *F* the two set screws. The object of placing the set screws in this position is to be out of the way of the bolts for holding the eccentric.

There are various notions about the placing of keys in driving-wheels, some placing them opposite the crank, and some upon the same side as the crank.

This appears to be a matter of taste rather than otherwise, for if the wheel fits the axle the keys are only a sort of safeguard to prevent the wheel from turning upon the axle, in case it should have a tendency to work loose. It is very much the same with the key *G*, which may be placed between the set screws *F*, *F* when so preferred.

This key, I suggest, be made like that shown in connection with Shop Kink No. 29, which was published in the American Machinist of April 8, 1882. For convenient reference, the engraving is here reproduced for the following reason: Since that "Kink" was published, I have learned that one of the prominent compound-engine builders in this country keys all of the eccentrics of his engines in the manner described in Kink No. 29. The kind of a key shown at *C* and *F*, does not require driving very tight, but will hold securely with a light pressure. This method of keying eccentrics and pulleys ought to be more extensively used than it is. When used for pulleys, a set screw ought to be placed in the hub of the pulley so as to bear upon the key near each end. This arrangement would prevent the key from working out, and yet allow it to be driven out with ease simply by slacking the set screws. The collars shown in Fig. 1 can be easily placed upon the axle before the wheels are put under the engine, the amount of lap and lead of the valve being known. A line is drawn through the center of axle *E* and bolt-hole nearest *G*, this line to be used to indicate the throw of eccentric. When this cannot be done, the collars may be easily shifted and secured in any position after the wheels are in place.

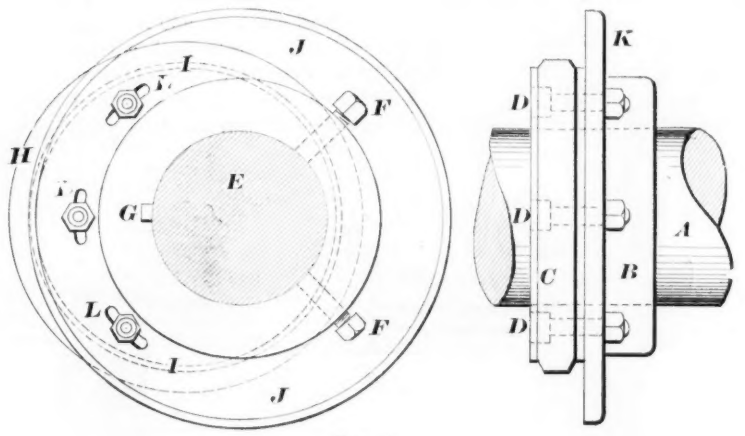


Fig. 1.

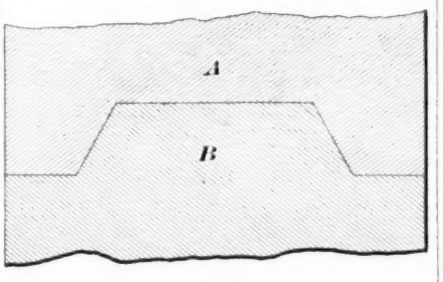
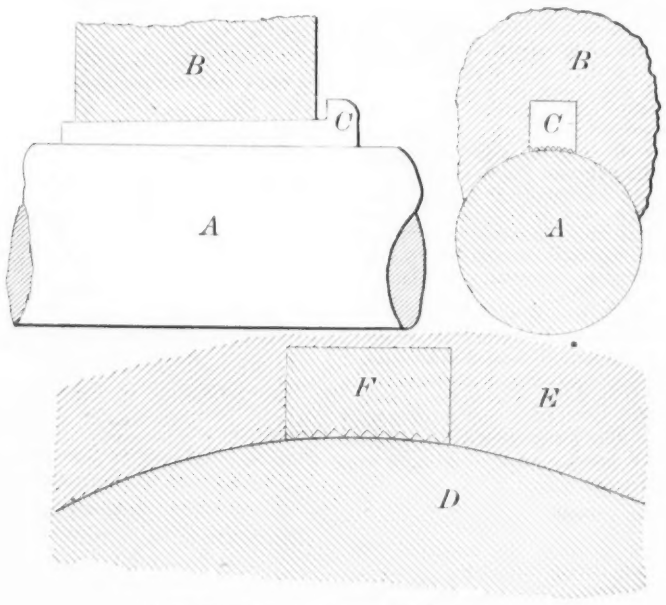


Fig. 2.



Keys for Pulleys and Eccentrics.

By means of the slotted holes for the bolts through the plate, the eccentric can be easily and quickly shifted little or much. All persons who have had any experience in setting valves know the difficulty of attempting to shift eccentrics to give a trifle more or less lead. When the eccentrics are set and the set screws again tightened, the tendency is to draw the eccentric back to its original position. Sometimes it occurs in consequence of the location of holes formerly made in the shaft by the points of set screws, that when these screws are tightened with the eccentric in its new position, they exert a force which ends to slip the eccentric.

It will be observed that all the power here applied to the eccentric to hold it is in such a direction that it does not spring it in the least. Yet there is less liability of its slipping with this device than when held with set screws. An essential feature of this device is that it permits the use of an eccentric of smaller diameter than could possibly be used without it.

The circle *H* represents the outside diameter of an eccentric 15″ in diameter, which is found necessary to prevent its being too much distorted by tightening the set screws and driving the key. With the device here shown, the diameter of the same eccentric may be safely reduced to 13½″, and insure a round eccentric, as well as greatly reduce the surface velocity. The set screws, *F*, *F*, should be placed precisely in the middle of the hub to prevent them from springing the collar unequally when they are tightened.

Another advantage of this device is that the eccentric may be placed nearer the middle of the axle, which removes them farther from the inequalities introduced by the rise and fall of the axle in the boxes. The rocker boxes, too, can be made longer there, giving a longer bearing upon the rock-arms, which is also advantageous. When it is desired to move any one of the eccentrics it can be done at once without disturbing the others, as is necessary where the usual method of holding eccentrics by set screws and keys direct is employed.

Some years ago I found that in consequence of square shoulders at the edges of eccentrics the straps rapidly wore away, so that the flanges upon each side of the straps often broke off, frequently permitting the strap to slip from the eccentric and become broken. I adopted the plan shown in the accompanying full-sized sectional sketch, Fig. 2, where *A* represents the strap and *B* the eccentric. It will be observed that instead of using square shoulders the edges of the eccentrics are beveled at angles of 60°, which greatly adds to the strength of the flanges. Since the time this plan was adopted until the present time (about eight years) not a flange has been broken from an eccentric strap, and the durability of both wearing surfaces is greatly increased. Besides the lubrication is better and more readily effected.

It is understood that it is principally in rebuilding locomotives these alterations will be found of great practical value, as it would hardly pay to make such changes on one engine alone while undergoing running repairs simply.

Doing shop work by contract has been made prominent in the new car shops at Pullman. The shop foremen are paid salaries, and work is let to contractors, who hire their men, and generally work with them; but as these laborers are paid (every two weeks) by the company, it reserves the right to reject any one. The work is inspected by the shop foreman, and not until it is completed and has passed inspection is anything due the contractor. The system of piece-work at Altoona does not differ essentially from this.

Mr. Pullman is anxious to have these works do something toward the solution of the labor problem, a part of which, certainly, is to secure the best efforts of the workman by giving him the fruits of his superior skill, industry or facility, and this is secured to those who take contracts; and the contractor, as the employer of a few men with whom he works, will probably secure better service of his few employes than a great works will of its many; while the inducement always exists to gain the qualifications which will enable the workman to become a contractor himself. — *Railroad Gazette.*

Cleveland Engineering.

The Cleveland Civil Engineers' Club recently held its third annual meeting, upon which occasion Vice-President J. F. Holloway (general manager of the Cuyahoga Works) presided and delivered an interesting and appropriate address, a portion of which we reproduce from the Cleveland *Leader:*

Various industries of our city have been increased and widened in their scope by means of the erection of several large, commodious, and well-planned buildings designed for manufacturing purposes, among which may be named the "Cummer Engine Works," designed for the construction of high speed automatic cut-off steam engines. The superintendent of that company will fail in his duty to this club if he does not at his very earliest convenience supplement his valued paper on "Smoke Burning," with another upon the "Economical Use of Steam." Adjoining the works last mentioned there has recently been completed what, without doubt, is the largest steam forge in the United States.

With the new and improved appliances with which the building is filled, together with the additional machinery recently added to the other similar establishments in this city, there can be no doubt of Cleveland's retaining in the future, as in the past, its high reputation in the manufacture of forgings of all descriptions, including, as they do, wrought iron shafts of the largest size now required.

As indicative of the growing importance in which our city is held as a desirable and convenient point for the manufacture and distribution of various articles, there might be named several establishments that have been bodily removed from the Eastern States as well as of instances where branches of well known Eastern houses have been started among us.

Among the many things which have engaged the attention and interest of engineers, not only in this country but abroad as well, is that of making castings of steel. There are but few engineers engaged in structural work, who, I am certain, have not at various times felt greatly the want of some material which, possessing sufficient fluidity to allow of its being run into molds, should also have a high tensile strength, and a percentage of elasticity that would admit of its receiving violent shocks without injury, and at the same time be free from "blow holes" so as to admit of finishng, and which withal could be had at a reasonable price. Having watched with much interest the advancement that has of late years been made in the art of steel casting, and having had occasion to investigate the matter somewhat, I take pleasure in being able to say that so far as I have known, in no place have as rapid strides been made, both as to the improvement of the metal, as well as in the solidity and smoothness of the castings, as in our own city in the year just closed, and under the immediate care and skill of a member of this club, the superintendent of the "Otis Steel Company."

It is well understood that the rapid growth and prosperity of Cleveland during these later years has been largely due to the fact that this is the nearest and most convenient point where the iron ores of Lake Superior can meet the coke, coal, and limestone needed to convert them into metallic iron, with the least expense of handling or transportation. Within a few weeks past there has been put in operation in our midst a blast furnace which, in its size and appointments, will enable this question to be tested under the most favorable circumstances. I refer to the "blowing in" of the No. 1 stack of the Cleveland Rolling Mill Company, at their central works above the Connotton Valley Railroad bridge and on the Cuyahoga River. The furnace is of the largest class. The air is supplied by three of the largest sized blowing engines, and is heated by three "Whitwell stoves." The ore is transferred by steam hoisting engines, over movable tramways, from the hold of the vessel to the foot of the hoist-tower which connects with the "top house" of the furnace. The furnace has been in blast but a brief period, and while the product has been steadily increasing from 150 to 200 and recently to 220 tons of pig iron per day, it is safe to say that when all the conditions are favorable the quantity of iron produced will equal, if not exceed that of any furnace in the country.

When you consider the immense quantity of ore, coke, and limestone that must be moved and handled each day in order to produce this quantity of iron, you will understand how important it is that so far as it is possible to do so, it should be done by mechanical contrivances. The success of the enterprise will be watched with much interest, and if its financial results shall prove as successful as has the engineering part of the scheme, it will not only be additional testimony of the wisdom and sagacity of that great iron master, Henry Chisholm, but it may also result, in the future, in placing Cleveland, Ohio, alongside of the Cleveland district of England, as one of the world's great centers in the production of pig iron. Since the above was written there has appeared in the papers a report of the action taken before the Legislature of Pennsylvania by various iron and steel companies in that State, in which, pleading for an exceptionally low rate of freight in order that works situated so far inland may exist at all, they say that if they are not so favored they cannot hope to compete with Cleveland, whose superior location is universally acknowledged.

* * * * * * *

Another and very interesting event is the completion of the Kinzua Viaduct on the Bradford branch of the New York, Lake Erie & Western Railroad. Its length between the abutments is 205 feet, and it is divided into twenty-one spans; its greatest height is 302 feet. The girders are supported by wrought iron columns, which are of a uniform width of ten feet at the top, the bottom varying according to their length, due to a batten of two inches in one foot, which gives the longest columns a base of one hundred feet in width. The erection of the bridge was greatly forwarded by the use of a pair of rather peculiar derrick poles. These poles were clasped at a point one side of their middle to the first pair of columns, and after they had lifted another column on top of the one to which they were fastened, the down or long end of the pole was turned upward by a swivel joint in the fastening, and there newly fastened to the last column set up, being then in place ready to hoist, and set up another column above the one to which it was fastened, and so on until the erection of the entire column.

Regarding the Brooklyn Suspension Bridge, which has so slowly progressed during several years past, I would suppose the announcement recently made that all the steel had at last been delivered, must have been heard with great satisfaction by the taxpayers, out of whose pockets this steel, or possibly other *steals*, have been paid for. A recent visit to and a trip over the bridge satisfied me that as a specimen of engineering it would be a credit to the profession. A brief examination of the work of tunneling the Hudson River, made at the same time, satisfied me that it would not be a success as it was then being executed, and subsequent suspension of the work would seem to confirm my views as then expressed. In regard to the plan of furnishing steam for power and heating purposes through pipes laid in the streets of New York, as is now being done by a company whose president is a well-known Cleveland gentleman, it would as yet be too early to express a decided opinion, as there are many features connected with it for which there is as yet no precedent from which to judge; but from what can be seen of the plant it is very evident that the details have been well worked up and carefully carried out.

The matter of selecting the most suitable oils for lubrication under different conditions is one worthy of more attention than it receives.

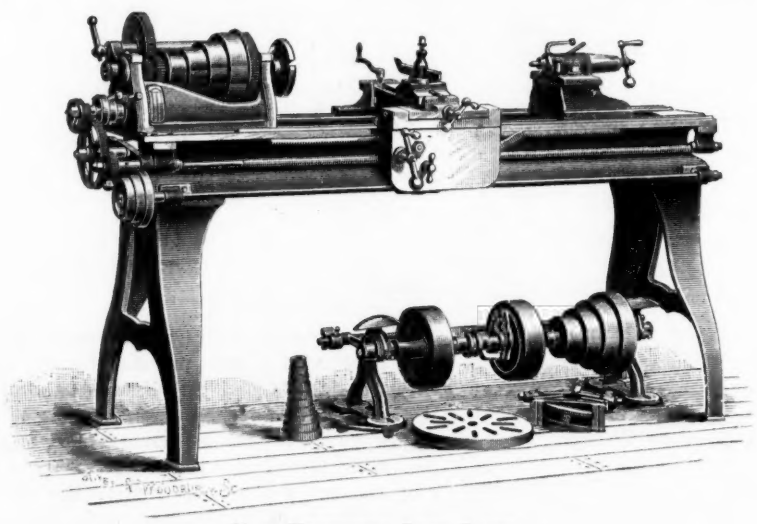
A good deal of the power of the prime mover in a manufacturing establishment is absorbed by friction before it reaches the work, and in many instances much of this waste could be avoided by the judicious choice of lubricant. It does not follow that because an oil is good in one instance it will be the best, or suitable, under different conditions, or that a mixture of oils would not be better than any single oil.

The selection of the best oil for specific purposes is largely a matter of experiment, but much valuable knowledge would be available if the results of different experiments in this direction were more generally known.

A New Fourteen-Inch Lathe.

The engraving on this page represents a new engine lathe of fourteen inches swing, one of the standard line of lathes made by F. E. Reed, of Worcester, Mass.

The aim has been to construct a lathe that should possess the qualifications adapting it to light and fine work, in which case, ease and rapidity of manipulation are important features. At the same time it must possess the necessary strength for as large work as can be done on a lathe of this size. To attain these ends no reasonable pains or material seem to have been spared in this instance. The bed is deep, wide, and of extra strength, insuring a firm and solid support for all the working parts. The head has a cone pulley large in diameter, with four changes for a belt two inches wide. It is strongly geared. The spindle is hollow, and has a front bearing $1\frac{3}{4}$ inches in diameter and $3\frac{1}{2}$ inches long, with a back bearing correspondingly large and long. The tail stock is fitted with a spindle large in diameter, and is clamped to the bed with two bolts through a shoe on the underside of the bed. It has long bearing surfaces on the ways, is strongly and substantially made, and neat in appearance. The rest is particularly strong in all its parts. It is provided with long bearings upon the bed, and all the sliding parts are scraped to as nearly perfect contact as possible. It is held to the bed by gibs on front and back side. The apron is strongly geared, and the feed is by a rod connected to a worm and worm-gear having an improved friction, simple in construction, and of proved strength and durability. The connection with the leading screw is by an open and shut nut, and the lathe is made to cut right or left hand threads, or feed right or left, by moving the small lever shown on end of head-stock.



NEW FOURTEEN INCH LATHE.

A patent friction countershaft is furnished with these lathes, the construction of which is such that compensation for the wear can be evenly and readily adjusted by one screw, and all its working parts are exposed to view.

The *Shoe and Leather Reporter* says:

"The aspect of affairs for the time being is such as to encourage the belief that we have seen the worst of our troubles, and that the future is full of promise. We have got a good deal of dear leather in the vats yet that will have to be disposed of, but every side of it will appreciate in value if we are not in too much haste to make more. There are some large establishments in which the working of hides has been materially curtailed. A majority of them, we think, are not being run to their full capacity. In the largest tan yard of the Middle States operations have been entirely suspended as far as relates to new stock. The good effects of the policy of retrenchment manifest themselves in the declining prices of hides. There is some accumulation of supplies in first hands. This is an excellent place for them."

A New Alloy.

It has long been known that the introduction of iron into alloys of copper and zinc materially alters the physical properties of the products for the better. Several attempts have been made to use iron in this connection, but hitherto without practical success. Experimentally the results have proved satisfactory, but when tried on a working scale the process has failed from a want of uniformity in the products. Among others who have directed their attention to the matter is Mr. Alexander Dick, of London, who, after careful experiment and research, has succeeded in introducing the iron into the alloy, in such a way as to give good results on a practical scale. This success is obtained by previously alloying the iron in such a manner that it is combined in definite and known proportions with the zinc. When ordinary wrought-iron is introduced into molten zinc, the latter readily dissolves or absorbs the former. The exact point of saturation, or the proportion dissolved or absorbed varies with the temperature at which the molten zinc is maintained during the process; and it is by carefully ascertaining and controlling this temperature that Mr. Dick has been able to succeed in obtaining a perfectly uniform product. The metal thus produced, and to which the name of Delta metal has been given, is stated to be as much superior to brass as phosphor-bronze is to gun-metal or as steel is to iron. It has an excellent color, is very easily worked, takes a high polish, and tarnishes less quickly than brass, and on the whole appears to be susceptible of a very wide application both for useful and ornamental purposes.—*St. James's Gazette.*

A correspondent of the *Mechanical World* communicates the following on case-hardening:

"The parts to be case-hardened are finished, with the exception of polishing. The carbonaceous composition is a mixture composed of equal parts of bone dust, scrap leather and charcoal, and before using they are slightly burnt on a thin iron tray to drive off moisture. A layer of the mixture is then placed in the usual wrought-iron box, made from $\frac{5}{16}$ inch plate, and the articles to be cased are put in and covered with the mixture. Another layer of articles is then put in, and so on alternately, always taking care to fill in between the articles, and cover every part well with the mixture. The box lid should fit easily, and, after placing it on, the edges should be luted with fire-clay, in which has been mixed a handful of common salt, to prevent the clay from cracking. The box should be placed in a furnace, and gradually heated to and kept at a bright red heat for six or seven hours, according to the depth of casing required. The box should then be allowed to cool gradually, and when taken out the articles will have a series of beautiful colors, ranging from a light straw to deep violet. Those pieces which require hardening are heated gradually in a clean fire to a blood-red, and then plunged into cool water. They will be found hard enough for all ordinary purposes."

Articles of incorporation have been filed with the Insurance Department of this State for the organization of the New York Boiler Inspection and Assurance Company. The incorporators and directors are Professor R. H. Thurston, J. W. Murray, J. H. Flagler, Geo. R. McKenzie, Professor Wm. P. Trowbridge, J. V. V. Booram, W. F. Proctor, J. O. Hardenburgh, Chas. E. Emery, Joseph Stone, B. G. Clark, Peter Nottman and F. W. Smith.

The Northwestern Lumberman has claimed, and still claims, that it has not been proved that the cause of the floods which have been so numerous in our rivers of late years was the cutting off of the timber along the banks of the streams.

New Bar Iron Shear.

We present with this an engraving of one of the standard bar iron shears, made by Hilles & Jones, Wilmington, Del.

These shears are made in four sizes to cut flat, round or angle iron. They are especially adapted to be used in locomotive building and repair shops, and by bolt makers, bridge builders, or for cutting puddle bars in rolling mills. As will be seen the pinion shaft of the machine is fitted with a tight and loose pulley, so that no countershaft is required. The cutter can be driven continuously for ordinary work, or by using the clutch the cutter can be stopped and started, leaving the gearing to run continously. This is convenient when it is desirable to cut with great accuracy. A gauge is furnished with the machine, to be used in cutting a large number of pieces to exact length.

These machines are of substantial construction, with ample bearing surfaces, adapting them for continuous use.

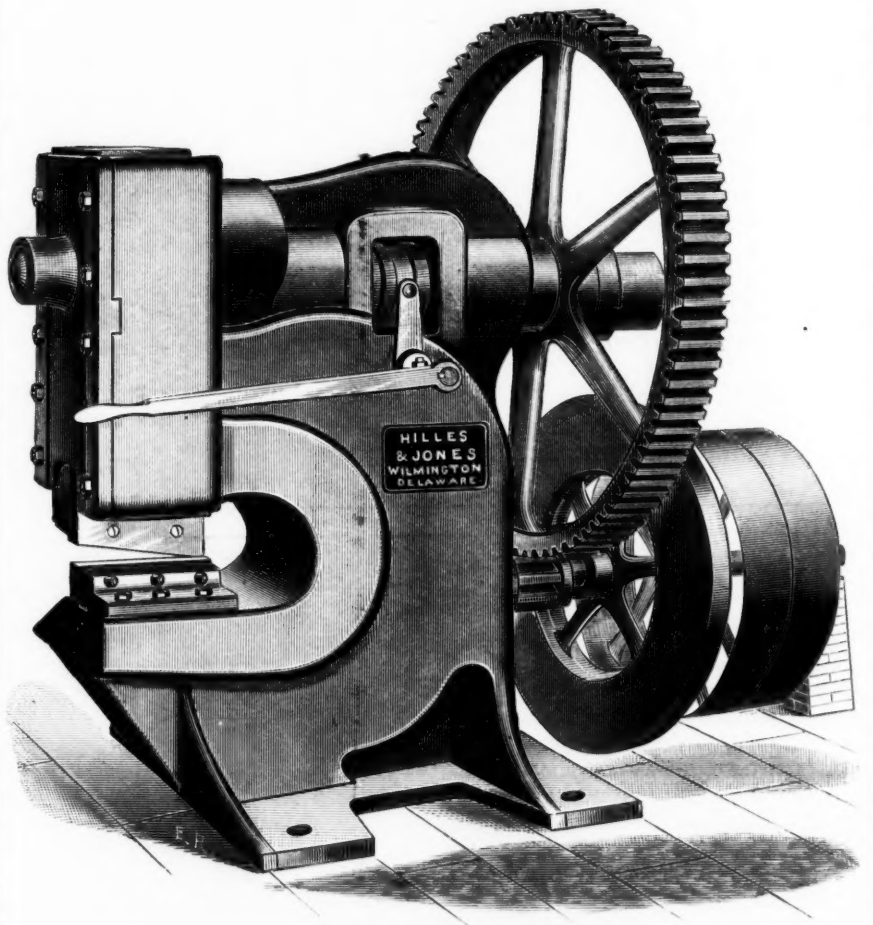
No. 1 will cut flat iron 4″x$\frac{3}{4}$″, No. 2 will cut 6″x1″, No. 3 will cut 8″x1$\frac{1}{4}$″, and No. 4 will cut 10″x2″. Corresponding diameters of round iron and sections of angle iron may be cut with the same machine.

Southern Competition in Cotton Goods.

The drygoods merchants of New York are agitating the question of re-classification of cotton goods for shipment by rail. They have held meetings, and stated to the freight agents what changes they want. They claim that with existing rates they are unable to compete in Cincinnati, Louisville, and other Western commercial centers with the Southern cotton goods manufacturers, who are now formidable competitors. The only relief the New York City houses can see is a reduction in freight charges. The New York *Times* states the matter as follows:

"The question on the surface seems a simple one, and the suggestion of the merchants plausible as a means of affording them relief. In reality the question is one of the most formidable as well as delicate the traffic managers of the railroads have been called upon to consider. It goes far beyond the question of freight rates. It is a question of the future existence of the great cotton industries of the New England States It is a battle for life by those manufactories against their offspring in the South. The transportation of these domestics to the West is a very large source of income to the trunk lines, and therefore it is to their manifest interest to foster the business, and prevent all possible encroachments upon it in the markets of the Northwest and West. They find the young blood of the Southern manufacturers and railroads foemen such as they have never herctofore been called upon to meet. During the past few years New England heads and hands with ample capital have gone South; and these, with New England machinery, New England looms and spindles, on the ground where the cotton is grown, have begun, on an extensive scale, the manufacture of sheetings and shirtings of a quality in no way inferior to the New England product. These goods can be laid down in St. Louis, Cincinnati, Louisville, and other centers, at a less price than New England manufacturers can afford, for this reason: The New England or New York manufacturer has to pay to get his material from the fields to the mills a freight charge which eats materially into his possible future profits. For instance, his freight from Atlanta, Ga , to Lowell, Mass , two central points, is 85 cents per 100 pounds. Should the manufacturer be able to buy to equal advantage at the seaports, Savannah, Charleston, Port Royal, or Brunswick—virtually an impossibility—his freight charges would be from 50 to 75 cents per 100 pounds. To this must be added the charges for carting at various ports and the loss of cotton by theft and 'leakage'—the latter often no small matter. At the outset, then, the Northern manufacturer, even when he buys direct from the planter, is handicapped with a charge hardly noticeable, to be sure, on a yard of sheeting, but amounting to a large amount on a case, and to a moderate fortune on a year's product. There is no material difference in the cost of manufacture, certainly not enough as against the Southern manufacturer to offset the handicap of freight charges placed on the Northern manufacturer. The Southerner is nearer the Western and Northwestern trade centers, and so can reach the consumers at a less cost for freight than can the New Englander. Then, too, he deals direct with the consumer, while the New Englander, in accordance with time-honored precedent, deals through a commission house in this city.

"The Northern manufacturer goes to the market and sells a case of goods, say for $50, to a Cincinnati merchant, who finds the case costs him $52 when it reaches his store, with freight and trucking charges paid. The Southern manufacturer, through his agent, sells and delivers at the same store a case of goods of the same quality, made of the same material with the same looms, for $51, and the Southern manufacturer makes the most money out of the transaction, as he has no handicap to start out with and no commissions to pay. The $1 a case saved to the Cincinnatian is no great amount on a single case, but on a year's sales it is a very large amount. Naturally, therefore, he goes to the Southern market.



NEW BAR IRON SHEAR.

"New England manufacturers have discussed seriously the proposition to take their business out of the hands of the commission merchants of this and other Eastern cities, and of dealing, as their Southern competitors do, direct with the consumers. Their agents would, however, cost them as much as their commissions to the houses in this city, and they find the initial freight handicap and freight rates after manufacture staring them in the face. How, then, to maintain their supremacy in the markets of the West is a question they are trying to solve. How to keep their business in domestics and their Western trade in their hands is the aim of the commission houses.

"Just here the freight-rate looms up as a possible relief, and hence the petition for a reclassification and lower rates. The railroad interest here enters as another factor in the trying problem. If the railroads of the East reduce the classification of domestics, and thus lower the freight rates, it would certainly afford relief, provided the Southern roads did not also reduce their classification and lower their rates. In order to protect the Southern manufacturers—which they have as much interest in fostering as do the trunk lines of the East—they would meet reduction by reduction both in classification and rates. This done, and the merchants and manufacturers of the North will be left in exactly the same position that they are at present. The Southern roads would certainly do what is here outlined, and the traffic managers of the Northern lines are well aware of this, and know, also, that because of less mileage over which to draw the freight the Southern roads would be able to carry at a less rate than they could. 'What benefit, then, would it be to us to reduce the tariff?' asked a freight agent of one of the trunk-line roads in discussing the vexed question. 'We should get a smaller income for carrying the goods if we reduced the classification, and would in no way benefit the Northern manufacturers or merchants. The Southern merchant has them at a material disadvantage, and it seems beyond our power to remedy this state of affairs, much as we would like to do it for our own selfish reasons, if for no other. The development of the resources of the South by the infusion of new blood and the adoption of new methods is naturally followed by manufacturing the materials produced by her within her own lines. It is impossible to prevent this natural result, and we must suffer from it in common with the manufacturers and merchants. If there is any method of relief from such suffering, I would thank the political economist who would find it, and not only thank him but pay him roundly for his solution of this extremely practical and very puzzling question.'"

Effect of Prison Stove Contracts.

M. L. Filley, a prominent stove manufacturer of Troy, N. Y., gave the following pointed testimony before the Legislative Committee investigating the prison-labor contract system. He said:

"The proof already before the committee is abundantly sufficient to demonstrate the enormous injustice of the State's entering into a ruinous competition with its own citizens in any branch of industry. This is generally conceded by the advocates of convict labor; but they contend the amount of convict productions is so small, compared to the whole amount produced, that the injury is too trifling for consideration. In this they seem to ignore the well-known fact that a single dealer among a hundred or a thousand, in any locality, offering his goods at any considerable reduction in price, necessarily compels all the rest to offer the same goods, down to the same level, at whatever sacrifice. My works are at present entirely idle, and have been for the past three months, and are so because of the want of orders from parties who are supplied by the products of convicts, by and under the authority of the State, at prices below the actual cost of the same class of goods made by honest labor in my employ."

According to the official statement of the Mexican Department of Public Works there had been built in Mexico up to the close of 1882 about 2,305 miles of railway. The miles of track now operated is given as follows:

Mexican Railroad (Vera Cruz), 356 miles; Mexican National, 432; Mexican Central, 596; Sonora Road 318; Interoceanic Road, 188; Yucatan Railways, 60; Tehuantepec Road, 16.

The tallest chimney in the country is at Lowell, Mass. It has the following dimensions: Height, 282 75 feet; diameter of base, 28 feet; diameter under cap, 15 feet. It is surmounted by a cast-iron cap 21 feet in diameter, weighing over nine tons. One million and fifty thousand bricks were used in the construction.—*Troy Evening Standard.*

"Creep" in Machine Belts.

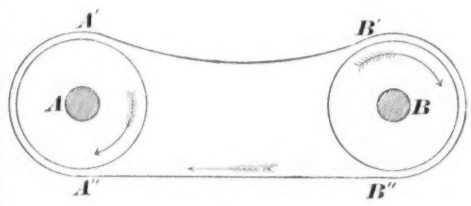
FROM THE MECHANICAL WORLD.

The majority of belt users, the exigencies of whose business require them at times to compare the actual with the calculated speed of their machinery when driven by belts, must often have noticed, that however carefully they may measure up the diameter of their pulleys, and, after adding to this the mean thickness of the belt, perform their calculations, yet the actual speed of the ultimate driven pulley is rarely, if ever, exactly that which would have been expected. Not that this variation is often of practical value. With well designed pulleys and shafting, easy running journals, and due attention to cleanliness, lubrication, and repairs, this apparently unavoidable slippage is reduced to a minimum, and in the vast majority of cases may be entirely ignored. It is, however, the duty of the specialist to take cognizance of the trifles, so long as they in any degree affect the matter in hand. It is of interest to inquire what is the cause of this apparent slippage, and how it can well be obviated, totally, or in part. It will be noticed by careful observers that, be the belt never so large in proportion to the power to be transmitted, the slight difference between calculated and actual resulting speeds will still occur, but in a degree tending to decrease as the power of the belt is increased, though not precisely in proportion as the breadth of the belt or the diameter of the pulley is increased. If, then, no practicable increase in the power of the belt, or the size of the pulleys will completely do away with this apparent slippage, it may be accepted that the apparent slippage to which we at present refer differs essentially from the usual form of slippage of belt upon pulley which is caused sometimes by insufficient breadth, or length, or weight, or flexibility, or adhesion of the belt, and at other times by the employment of pulleys of too small a diameter, or too much crowned on the face, or otherwise of faulty design. It appears, further, that the total difference between the calculated and actual speeds of the ultimately driven pulley will increase or decrease almost exactly in proportion to the total number of belts through which the power is transmitted before reaching the ultimate pulley, whose variations in speed we are at present considering. This being so, the slippage must be cumulative, and to nullify its effects so far as possible, it obviously becomes advisable to insert as few belts as may be practicable between the source of the power and the place of its ultimate application. In cases where belts are driven at high velocities, it is found that the centrifugal force generated tends to decrease the adhesion between belt

and pulley, and thus affects the ratio of speed between driver and driven pulley. We may, however, pass over the centrifugal force, as its effect in the vast majority of belts is of but little practical importance.

Everybody knows that when an endless belt is used to transmit mechanical power by means of two pulleys the tension of the two sides must vary. The driving side, *i.e.*, the portion transmitting the power, is subjected to a greater tensile strain than is the following or slack side of the belt, and, as what was the following portion in its turn takes the place of the driving side and becomes for a time the tight portion, the excess of tensile strain is removed, as it were, along the belt. In the sketch, where A is the driving pulley, B the driven pulley, and where the belt A' B' B'' A'' is traveling in the direction of the arrow, the belt will be delivered on the pulley B at a point B' while subjected to a less strain than that to which it is subjected on leaving the same pulley at a point B''; and, further, the belt will leave the pulley A at a point A' while under a less tensile strain than it is subjected to at the point of its reception by the pulley A at A''. Further, all materials of which belts are generally composed are more or less elastic, and, therefore, there will be some change in the length of a given portion of the belt, accordingly as it is subjected to greater or less tensile strain. Measurements of a given portion, while subjected to a working strain upon the side A' B', compared with measurements of the same portion when subjected to the conditions obtaining on the slack side, will show this to be the case, and the greater the total length measured the more apparent will be the difference in length referred to.

Architects have long known that lead, when used for covering inclined roofs, tends to move, in course of time, in a downward direction. This is caused by the alternate expansion and contraction of the metal, due to differences in temperature, combined with the action of gravity upon it. This movement of lead is technically known as "creeping." The particular motion of belts which is the subject of these remarks is in great measure analogous to it, and the word has been adopted to describe the phenomena noticed in belts. The total length of belt passing any point in a given time obviously cannot exceed the total circumferential traverse of the effective radius of the driving pulley A, the effective radius of the pulley being equal to the distance from the center of the pulley to the center of the belt. This being the case, it must follow that the total length of belt taken up at A'', where it is stretched and longer, must be greater than the total length taken up at B', where it is slack and shorter. And the length delivered at B'' and the length taken up at A'' are equal, while the length given out at A' and the length taken up at B' are equal to each other, but less than the lengths delivered and received at B'' and A'' respectively. But the circumferential velocity of the pulley A must, of necessity, be the same at A' as at A'', and that of the pulley B at B' and B''. Where, then, does this longitudinal elongation and contraction of the belt occur? The elongations of the belt must take place within that portion of the belt which is in contact with the surface of the driven pulley B, while the corresponding and isochronous contractions must take place within that portion of the belt which is in contact with the surface of the driving pulley A. And these repeated elongations and contractions must, for a given space of time, be equal to each other, otherwise the belt would be permanently lengthened or shortened. The more elastic the belt is the greater will be the amount of "creep." In practice, thoroughly-stretched leather shows an almost entire absence of it. Reliable data bearing upon this subject are difficult to obtain, but we have before us memoranda of the results of some experiments which are of value in the present instance. The power from a steam engine was transmitted by means of belts throughout the whole of a large factory, and a comparison made of the speed of the engine with the actual and the calculated speeds of a shaft at a considerable distance from and driven by that engine, through a range of five belts and five pair of pulleys. Counters were attached to the engine and to the shaft referred to, and simultaneous readings of the two counters were taken at the end of each interval of five minutes for the space of one hour. The four most noteworthy results thus obtained were as follows, from which the ratios of speed obtaining are calculated, and for convenience of reference tabulated also. We also append



the total recorded number of revolutions and average ratio of speed for the hour of observation:

Table I.

Revolutions of Engine.	Revolutions of Shaft.	Ratio of Speeds.
159	417	2.6226*
153	397	2.5948
154	403	2.6169
148	383	2.5878*
Total for 1 hour, 1,848	4,816	2.6061

* Greatest variation, .0348.

It may be mentioned that each of the five belts forming the connection between the engine and shaft was of dimensions largely in excess of what was required by the amount of actual work to be done. The engineer had acted upon the precept which enjoins us to let the belts be masters of their work. Careful measurements of all the pulleys were then made, one thickness of the belt upon each pulley being added to the actual diameter of the bare pulley, so as to obtain the effective diameters. Calculation then showed that the speeds of the engine and of the shaft should have been in the ratio of one revolution of the engine to 2.6251 of the shaft, had no "creep" occurred. Therefore, there would appear to have been in this instance an average "creep" of .4952 per cent. It was found advisable to increase the speed of both engine and shafting. This being done, similar comparisons were made of the speeds under the altered conditions, with the results which in part we tabulate below:

Table II.

Revolutions of Engine.	Revolutions of Shaft.	Ratio of Speeds.
205	538	2.6244*
204	535	2.6225
203	532	2.6207
208	544	2.6154*
Total for 1 hour, 2457	6432	2.6174

* Greatest variation, .0090.

From this there appears to have been an average "creep" in this case of .2724 per cent.—an amount very much less than was originally the case, being less than that (by .2228 per cent.) of the whole number of revolutions, or by nearly 45 per cent. of the total average amount of "creep" under the conditions of speed formerly obtaining. It is generally believed that there is one rate of traverse at which belts will most nearly cause to approach the actual and the calculated speed of the belt-driven machinery; and it would appear, from the results shown in Table II., that this condition was very nearly obtained by the alteration in speed which was made in the instance from which we take our examples, between the observations upon which are founded the two tables here produced. An average loss of speed from "creep," which amounts to only .2724 per cent. for five intervening belts, or of .0545 per cent average for each individual belt, approaches very nearly that positive accuracy which is obtainable only by means of geared wheels, or a combination of chains and toothed wheels, and in probably not more than one case in a thousand would such a slight discrepancy be felt at all in practice. These exceeding small results are obviously due to the surplus strength of the belts. Generally speaking, however, the loss of feed by "creep" is much greater than this, 2 per cent. in new single belts having been observed.

LETTERS FROM PRACTICAL MEN.

Lathe Boring Tools.

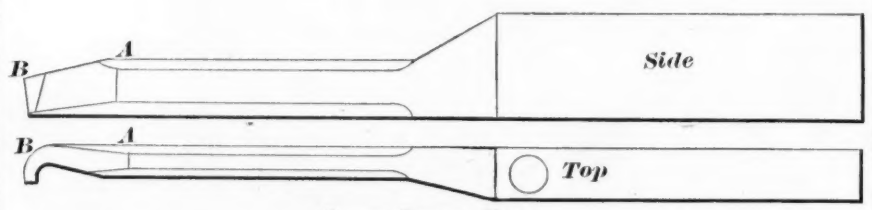
Editor American Machinist:

In one of the numbers of the American Machinist of last year, I remember seeing engravings of some lathe boring tools as they are usually made and placed upon the market.

I have, as I believe, a very much better style of tool to do work. I forge the tool the other side up from your cuts, so that I can draw it back and attain all the stiffness possible, and not overhang the rest any more than is necessary. The bit of wood sent (represented by the annexed cut) is to represent the steel forging just as it leaves the hammer. The cutting-point can be finished with a file to suit the idea of the workman and the kind of job on hand. When forged, harden the tool to suit the work. You will imagine yourself forging a steel tool like this; the last thing then to be done is to turn the round corner on a suitable place on the anvil, and with a hammer draw the slant from A to B. Now inspect it, holding that end straight towards your critical eye. Then bring the corner B precisely on a line with the middle of the shank part. Do not strike with a hammer to move the grain only when it is about cherry-red, and finish off with very light blows on top, continuing lighter and lighter as the heat decreases. When finished with a file, remember that the nearer the cutting edge is to where the face of the hammer touched, or skin of the metal, the better and more durable will the edge be.

Taylor B. Lakin.

Bennington, N. H.



Lathe Boring Tool.

Another Surface Gauge.

Editor American Machinist:

From the large number of surface gauges published in your paper of late, one would suppose that the last member of the family had been born, but as none of those published are precisely like the one I have, it may not be amiss to publish a cut of it. Furthermore it may suggest an idea to the boys who may perhaps be induced to make one for themselves. The base E, Fig. 1, is made of cast iron hollowed out, as shown, to make room for the nuts C. The standard F, has a hole bored its entire length to receive the screw A, having a milled nut at the top. All end play of this screw is taken up by the lock nuts C, at the bottom, to take up wear between the shoulder H, and lock nuts. A slot, I, I, is planed or milled through the standard F. The width of this slot is $\frac{3}{16}$", and is made for the purpose of receiving the block G, which is held in the slide B, by means of a screw with milled heads.

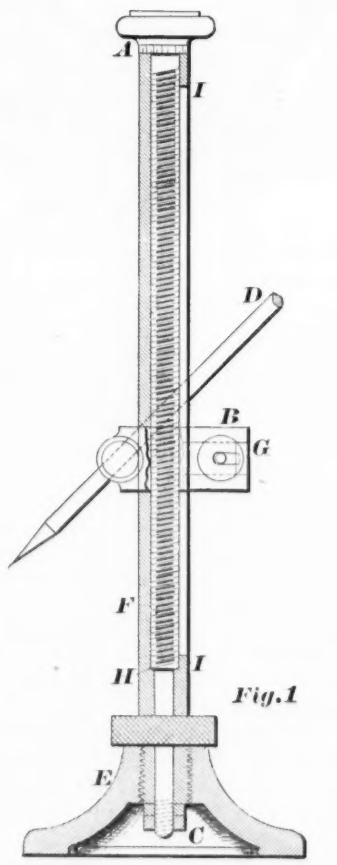
The block G, is cut like a chaser at the end to fit the threads upon the screw. This will be better understood from Fig. 2, where K represents the slide, J the block and N the thread cut in the end of it.

By loosening the screw L, the block J may be thrown in or out of gear with the screw, so that the slide may be quickly adjusted to any desired position upon the standard. By loosening the tapered bolt O, the scriber D may be also adjusted to suit all requirements.

By tightening the nut M, the slide as well as the scriber are securely held. By graduating the head of the screw at A, the scriber may be easily raised by $\frac{1}{100}$ inch or less, according to the graduations. A very fine adjustment may thus be secured. The rest will be understood without a further description.

Pulley.

Poughkeepsie, N. Y.



Surface Gauge.

Raising Planer Heads—Planer Graduations.

Editor American Machinist:

In your issue of March 17, "Planist" details some points about raising planer cross-heads to clear the work. If he will find out how many turns of the handle it takes to raise the cross-head one inch, and then do a little measuring before he begins, he will not find it necessary to murder time by getting on and off a box in the manner he describes. All he will need do is to count the turns. The only advantage I see in his plan of graduating the upright is to save measuring the distance between platen and cross-head. The most serious objection I see to the modern planer is in the way the graduations for setting over to plane angles are made. This is all wrong, and tends to confusion. The present practice in this respect ought to be reformed.

Toledo.

Chattering Tools—Creating Skill.

Editor American Machinist:

A writer in your journal alludes to chattering tools when turning heavy work chucked on the face-plate or in a chuck. Chattering in such cases is not caused so much by the tools as by the faulty con-

struction of the lathe. Nine-tenths of the *puttering* with tools to get them to work reasonably smooth on work in the face plate would be avoided if the headstocks of lathes were made as solid as they should be, with spindles large enough to do their work without springing, and the skeleton face plates were made to go as far as they would in the foundry towards making one of reasonable strength. The fast head-stock is a fixture, and ought to have a good deal of the anvil principle in its make-up. Making it like a skeleton does not make the lathe any handier in use. It only saves a few pounds of cast iron.

I read your comments on "Creating Skill" with a good deal of interest and appreciation. The only way to provide skilled workmen is to carefully train boys through long apprenticeships. A grown man can never acquire the dexterity in hand-work that one can who commences young. This holds good, not only in mechanical operations, but in everything else in life. Even in machine tending, we see this demonstrated by the abuse of machines, misfits, and in various other ways.

I have seen a good many of these attempts at creating skill, but I have never seen them successful. In the shops where the best work is done, you will find them employing workmen who learned the trade at which they are working.

One trouble with the apprenticeship system in many shops is, there is no rule of advancement. Old and valuable apprentices find themselves kept behind some favorite from a shoe-shop, and the natural result is dissatisfaction. J. K. C.

Filling Drawing Pens—Long Lathes—Planer-Head Graduations—Wear of a Slide Valve.

Editor American Machinist:

I do not want to detract from the suggestion of "Apprentice" (March 10th), in regard to filling drawing pens, but rather to add my mite to the general stock. For some years it has been my custom, when medicine had to be dropped, to cut two small grooves in the bottle cork, one opposite the other. Air enters the bottle by one groove, and allows the liquid to flow by drops from the other. Reading the letter from "Apprentice," in connection with your remarks, I tried my "dropper" with a steel pen in one groove to guide the ink to the drawing pen. It worked to a charm, and has the advantage that several droppers can easily and cheaply be provided, for China ink, and colors for line shading; the dropper prevents rapid evaporation.

In reading Mr. Birkenhead's letter, I was struck with his remarks on high-speed belting. In my opinion, high speed for belts is necessary to keep up with our high-speed machines — steam and otherwise — and is quite proper; but if I met a case in which I found that a 1″ belt on a 14″ pulley (after repairs) did the work which was only done by a 4″ belt on a 7″ pulley, I think I would lay some of the blame where it belonged, viz., on the shaft lines.

As I have considerable experience in mill repairs, I would ask why, instead of two light lathes, would it not be better to have one long shear frame, with a head-stock on each end of the shears?

You may heartily want the tool that is only required once a year, and the rest of the time, figuratively, consigned to the scrap heap.

I do not see why our school instructions should be inverted or transposed by toolmakers. Looking at a map of the hemispheres, the degrees are marked from the equator 0° to the poles, 90°. Why don't some heavy planer sit down on those toolmakers and make them see this thing plainly?

With reference to the wear of that slide valve, it is impossible to give "J. S." a definite solution of his query without an examination of his engine valve gear; but I may hazard the suggestion that, if he causes the exhaust closure to come earlier, thus increasing compression, he will relieve the slide from a great deal of work at the most critical part of the stroke. A. WALLACE.

Leadville, Colorado.

M. E. D. Farcot's New Type of Double-Cylinder Vertical Engine.

We translate the following description of a compound engine, shown in the engravings, from *Le Technologiste*, a French publication:

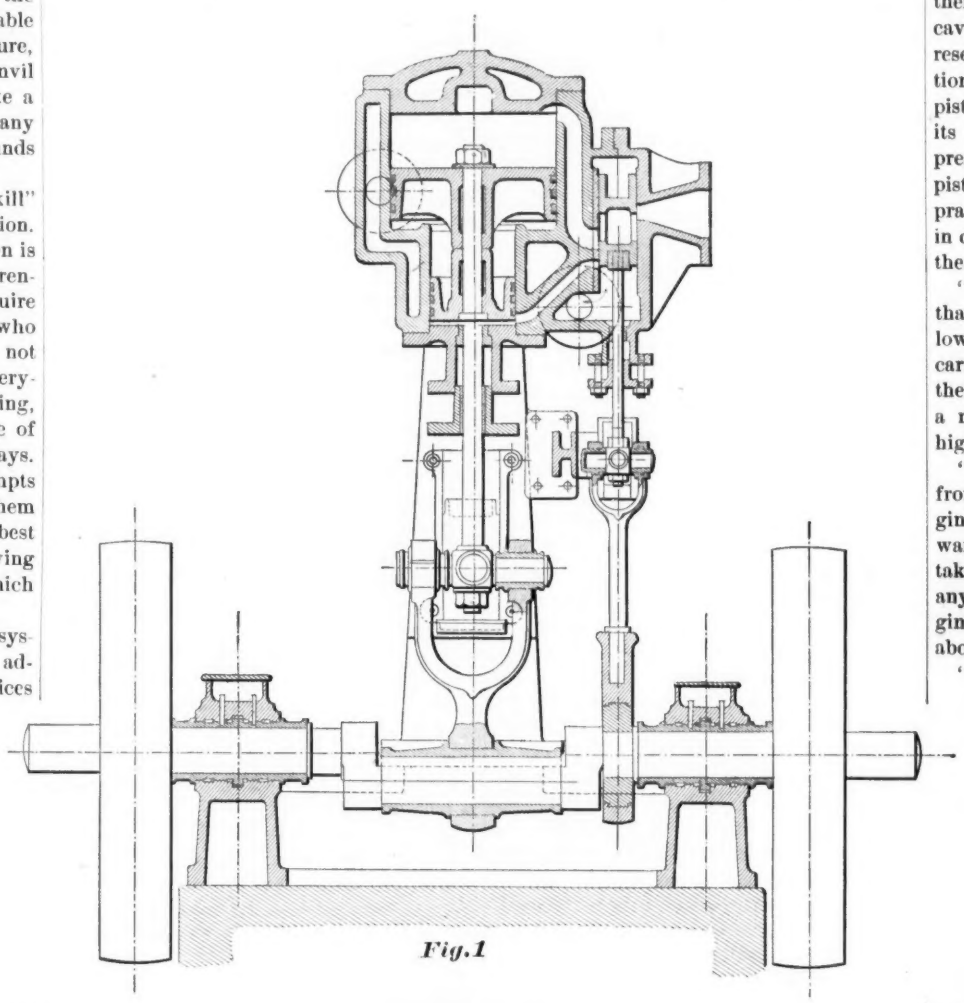


Fig. 1

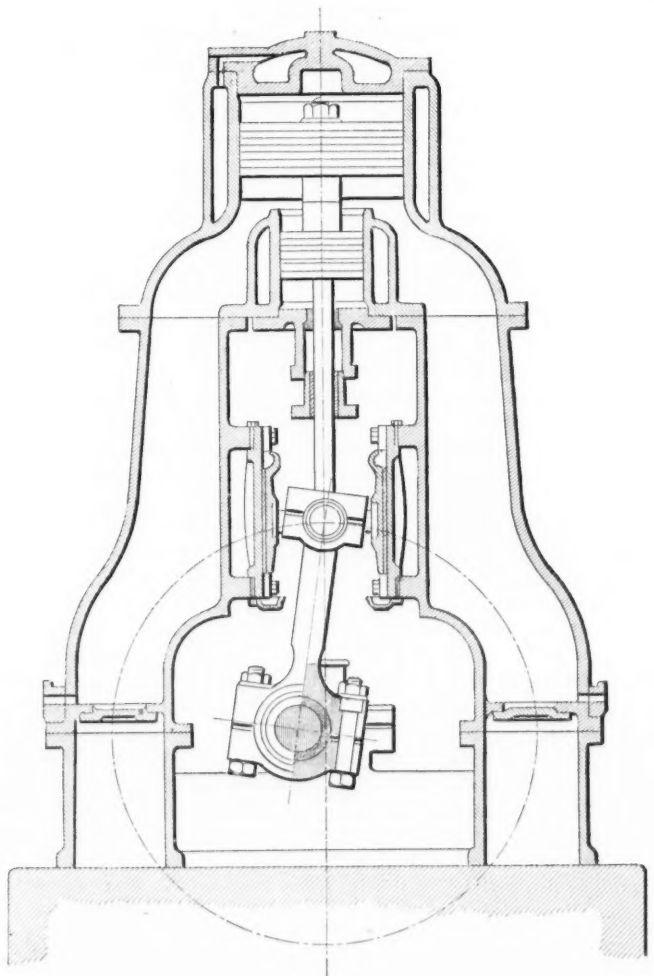


Fig. 2

A FRENCH COMPOUND ENGINE.

"The engine shown in Figs. 1 and 2, due to the patient researches of M. Emmanuel Denis Farcot, a mechanical engineer of Paris, is of the compound type, in which the steam expands successively in two cylinders.

"In the present case, the two cylinders, placed on the same vertical axis, are single acting; the arrangement is extremely simple, and requires only one stuffing-box, placed on the cover of the lower and smaller cylinder, to pack the rod common to both cylinders.

"To the ordinary advantages of compound engines, which are, as every one knows, the utilization of expansion without occasioning shocks or blows on the moving parts transmitting the motion, the arrangement of M. Farcot adds various others which are peculiar, and which enable him (having reduced to a minimum the necessary number of moving parts) to work at a great speed without appreciable wear, and consequently without frequent repairs, even with continuous running day and night.

"The steam introduced into the small cylinder by the lateral slide valve, furnished with the 'Farcot' cut-off, adjustable by hand (to the right of Fig. 1), works with full pressure all the way on the lower face of the smaller piston. Then, when this has reached the top of its stroke, it goes by a lateral port (seen in Fig. 2) to the under side of the larger piston, where it works by expansion, and thence flows away freely into the internal cavity of the frame, which forms a large reservoir for steam, in constant communication with the chamber separating the two pistons (Fig. 2). This arrangement has for its immediate effect the avoidance of back pressure in the chamber separating the two pistons, in which the pressure thus becomes practically constant. This reservoir is itself in communication with the exhaust pipe or the condenser.

"The general appearance of the engine is that of a steam hammer, of which the hollow frame is solid, with the base-plate carrying the plummer blocks (remarkable for their length of bearings), which guarantees a minimum of wear, notwithstanding the high speed.

"An examination of the diagram taken from the large and small cylinders of an engine making 120 revolutions per minute, warrants the statement that the expansion takes place under conditions as perfect as in any other system whatsoever. Such an engine, developing 15 horse power, weighs only about 8,000 lbs.

"In short, the chief advantage of this kind of motor is that of lending itself, better than any other, to a very high rate of running without giving any anxiety, and this by reason of its solidity and the small number of its moving parts. This important quality has commanded the attention of electric lighting companies, and one of them has ordered from M. Farcot a sample engine, to run at 400 revolutions per minute."

Engineering says of the raising of the steamship Austral, sunk in Sydney harbor in 50 feet of water: "The weight to be lifted was approximately 6,000 tons, and the means adopted consisted in securing to the ship's side, artificial water-tight bulwarks reaching to several feet above the water line, thus transforming her from a submerged to a stranded vessel full of water, but having the gunwale above the water-line. To render it possible to turn the vessel lengthwise, she was divided into two equal compartments, by means of a transverse bulkhead amidships, the doors of the other bulkhead being left open. The vessel, thus prepared, was pumped out by powerful pumps, placed equally before and abaft the transverse bulkhead. The vessel first came upright, and then steadily left the bottom, and as the pumping proceeded was towed into shallower water."

Quite a kink in testing vacuum gauges is one in use by L. S. Bunnel, of Troy, N. Y. It works satisfactorily up to 25 or 26 inches. He uses a small drum to which the gauge to be tested and the test gauge are attached. Steam from the boiler is admitted to the drum and the air expelled, when the condensation produces vacuum, the reading of the two gauges (the test gauge and the one to be tested) being compared as the pressure falls.

The Providence Press of March 19 has the following: "George H. Norman, of Newport, presented this morning to Henry D. Cozzens, Secretary of the Providence Stationary Engineers' Association, $50 toward the association's library. The association has also received from the Messrs. Thompson Brothers, of Glasgow, Scotland, nine large and handsome photographs of stationary engines. It may be added that Secretary Cozzens, who, by the way, is the engineer at the County Court-House, is feeling very well to-day, and his associates of the society will also feel well when they read this item."

The Mississippi river has, with its tributaries, more than 16,000 miles of waterway navigable by steamboats.

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NEW YORK, APRIL 7, 1883.

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Appropriating Machine Designs.

The law defines the appropriation of the property of others as theft, and, with the view to discourage the practice, attaches certain penalties to it.

If it could go further and bring a corrective influence to bear on the man who appropriates the ideas of others, it would sometimes be a good thing. The man who deliberately takes to his own use, and especially without credit, the ideas of another in the form of a distinctive machine design, may be honest according to common law, but he acts dishonestly according to common sense.

A builder or manufacturer devotes his time and genius to the designing of a machine, the general features of which have passed into the condition of common property, as much in the expectation that the design will represent actual value, as that the material and work that he puts into any single machine built from his design will represent value. The design is, mechanically speaking, valuable in proportion as it represents good features of construction, and as it connects his name with its manufacture it is to him commercially valuable.

For the most obvious reasons it is not satisfactory, and according to commonly accepted notions in other matters it is not honorable, for some one to metaphorically walk away with his property very much as a thief would walk away with his pocketbook. He naturally argues that decency and courtesy lead men to do things that the law does not compel them to do, and that to treat as having an owner something of value that is not recognized as property by law, is one of these things.

It may be urged that there are means provided by the operation of the patent law whereby valuable machine designs may be defined as property, and protected accordingly. This is true enough, but it would be altogether more satisfactory and infinitely more creditable if in the matter of something so conspicuous as a peculiar machine design it were not necessary to invoke this protection.

The design may be of a character to involve important improvements in the operation of a machine—almost or quite in the character of a radical departure from previous custom; or the chief object of the designer may be to add something to it that is particularly his own; or, together with peculiarities of design which may or may not be valuable, may be some peculiarity of arrangement or finish, of no economic value whatever, but which serve to identify the builder with its construction, much as his signature would identify him with a piece of paper until some one adopts the practice of forging it. Whatever it may be, so far as worth or utility is concerned, the case is not altered. The fact that the design as a whole has no intrinsic value does not change the fact that it has a value to the rightful owner, and rather adds to the crookedness of pirating it. On the other hand, the fact that it is intrinsically valuable is no excuse for the taking of it.

Fortunately, in the majority of instances, the best builders of machinery have respect for the rights of others in the matter of machine design, as well as a pride above classing themselves as copyists and a fair estimation of their own ability to design better than they can steal. It cannot be denied that considerable appropriating of this kind is done, but quite as fortunately, in the interests of justice, the mere copyist is seldom a success. If he lacks the ability to originate, he generally lacks the ability to copy successfully, and seeing only the *outside* of the originator's design, omits that which gives it real value. After all, such attempts usually serve in the end to call attention to the man who furnished the brains, and unwittingly he gets gratuitous advertisement. Unfortunately, however, this cannot do away with the feeling of vexation it engenders, and to a certain extent it brings discredit to the trade. If there is "honor among thieves," there ought to be enough of this quality amongst honest men to respect that which in equity belongs to another, although its ownership is not recognized by statute.

The Duties of a Superintendent.

We have from time to time received inquiries in reference to what constitutes the duties of a superintendent of a shop or factory. In answer to such inquiries, we may safely say that the duties of a superintendent depend chiefly upon the knowledge and mental disposition of the proprietor.

For instance, we know of a proprietor of a large machine establishment who recently decided to build a new shop. He selected from among his employes a young man who he concluded would make a good superintendent, and, after giving the young man a few computations in regard to yard area to be occupied by buildings, height of same, and other like details, he directed the new superintendent to go ahead, lay out the buildings, complete the drawings, and have the work of erection prosecuted as rapidly as could be done consistent with the best of work. After the work of designing and making the drawings was completed, they were submitted to the proprietor for approval. After suggesting some trifling additions, he signed the contracts, and the work of building was pushed forward. The selection of machine tools and shop appliances was placed entirely in the hands of the superintendent. The shop, when ready, was started up, and has been running successfully ever since under the careful management of the young superintendent, who is one of the very few who fully understand true economy in hiring men and boys, and in governing them.

The proprietor visits the shop about once a month, or whenever it becomes convenient. The superintendent has control of the bank account, buys all material used, and pays all the bills. The reason for this trust is that the proprietor knows that he has the right man in the right place, and has full confidence in his integrity, while the young superintendent is aware of the confidence his employer has reposed in him, and therefore regulates his conduct in a way which tends to bring him into still closer relations with his employer. In this shop the rules consist of six short lines.

A piece of fine machinery appeared in one of the prominent freight depots not long since for shipment. It had the manufacturer's name upon it, and was pronounced a creditable mechanical production of ingenuity and skill. Inquiry revealed the fact that none of the firm knew anything about practical mechanical manipulations, and never used a file, hammer, or chisel in their lives. The secret of their success was that in the shop they had a competent superintendent, who had the faculty of hiring and retaining competent men, and of selecting the right kind of boys and training them up in a way that commanded respect.

When asked the secret of success, Jay Gould remarked to a friend that it lay simply in having the right men in the right places. So much for this side of the question. Now for the other side. A certain superintendent of a shop is employed by a man who believes that everybody in his employ ought to think as he does, and that nothing ought to be done without his specific direction. He has a secret understanding with the sweeper and office boys to report to him incidents worthy of notice that may come to their knowledge. The superintendent does not escape this espionage, and some one of these spies even goes so far as to find fault with the proprietor in order to draw out the views of the superintendent to be regularly reported to him. When the proprietor is away, no one knows what new job to undertake. If a customer calls, no one is authorized to entertain him. The bookkeeper and clerks are at loggerheads with the superintendent, whose position is one of name merely, without authority. Each of these gentlemen claims the rights of superintendent. The foreman blacksmith insists upon doing as he pleases, and the boss boiler maker is not willing to allow either the superintendent or foreman blacksmith to show any authority over him, consequently things are so mixed that it costs about double what it should cost to get the work done.

Another illustration is contained in the following incident: A certain shop proprietor had a good corps of foremen and office help, and employed a good superintendent, who went to work with an absorbing interest in organizing a system for the management of the shop. Soon everything went merrily, and all concerned were pleased. One day the proprietor came in, and gave a piece of work to one of the workmen. The superintendent soon discovered that this man had stopped the job which he had been doing, which was promised for delivery at a certain time. Upon inquiry, the superintendent discovered the circumstances. The job given by the proprietor was dropped, with the injunction never to accept work from any one but the superintendent.

The proprietor soon after inquired of the workman about the job he had given him, and, after learning the details, sought the superintendent in a rage. The two met, and, after a few moments' contention, the piece of work was given to the superintendent, as should have been done at first. The latter would have given it to some one, so that it would not interfere with the regular work.

This proprietor had the very opposite disposition of neglecting to give necessary instructions to his subordinates; so they had to go ahead with a kind of intuitive knowledge of what was wanted. The proprietor, often seeing details executed which did not agree with his ideas, would find fault.

A superintendent should first assure himself of his competency to perform his duties, then go in search of a person who will have sufficient confidence in his ability to place him in a position which will be profitable to his employer as well as to himself, and an honor to both.

Literary Notes.

EXTRACTS FROM CHORDAL'S LETTERS. New and enlarged edition, with additional plates. Price, $2.00. John Wiley & Sons, New York.

As our readers well know, the contents of this book (except the illustrations) have appeared under the same title in the AMERICAN MACHINIST. The first two editions of the book were published and sold by us. It was more favorably received and commented upon by the press of this country, both daily and industrial, than any other book on mechanical matters that has ever come to our notice. Its reception by the mechanical public has been alike favorable. The publication of even one book, however, has been found to absorb more of our attention than we expected, and we have therefore made arrangements with John Wiley & Sons, the well-known publishers of mechanical and engineering works, to take both the publication and sale of this book, and to this firm all future orders should be addressed.

The new edition has been considerably enlarged, and the eight new full-page cartoons, sketched by Chas. J. Taylor (who so happily illustrated the book when it first appeared) are both amusing, appropriate and suggestive. The "extracts" that have been added to those in the original edition (making a book of nearly 400 pages) are from Chordal's more recent letters. It is worthy of note that some of these have been pronounced by eminent engineers, the very best that he has written.

The book has a new and tasteful binding and is every way creditable.

The *Electrical Review* is the new name of a handsome 16-page weekly journal, which proposes to deal with electric lighting, telephone, telegraph and electrical matters generally. The paper was formerly published semi-monthly under the title of *Review of the Telegraph and Telephone*. In shortening its name and broadening its field, the managers show appreciation of the growing importance of electrical discovery, and the first number issued under the new auspices promises well for the future. The paper has been enlarged to 16 pages and the same sized page as the AMERICAN MACHINIST. George Worthing-

ton continues in charge as editor, while Thomas H. Delano, a gentleman long and favorably known in newspaper circles is publisher. The paper will be published at 23 Park Row, New York, by Delano & Co., subscription price, $3.00 a year.

QUESTIONS & ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

(127) M. D. S., Dubuque, Iowa, asks: In laying up a boiler for the summer, if it is decided to leave it filled with water, should it be left with the hand-holes opened or closed, and should oil be added to the water? *A.*—The hand-holes and all other outlets should be closed tight. We believe it is a good plan to put some crude petroleum in the boiler a day or two before stopping.

(128) G. T. S., Lockport, N. Y., asks: Will you tell me how to find the necessary lift for the valves of force and section pumps? *A.*—There is no rule for this. In the case of very slow moving pumps the lift may be sufficient to give the area of pipe, but on quick running pumps the lift should be less in proportion to the speed. In ordinary practice the lift will range from 1-12″ to ⅜″.

(129) W. G., Paterson, N. J., writes: I am in charge of an engine and boiler. The boiler primes so as to be troublesome. I think of putting a perforated plate in the dome, in such a way that the steam will have to make a turn and then pass through the perforations before entering the steam-pipe. Will it be of any use? *A.*—We have no doubt that, by breaking the direct current, it will be of considerable assistance. It will not, however, make the steam dry.

(130) Reader, Norwich, Conn., asks: 1. What is meant by the throw of an eccentric? *A.*—Twice the distance the hole is out of the center, or the distance it will move a slide valve directly connected. 2. How can it be measured? *A.*—By measuring the greatest and also the least distance from the shaft to the outside of the eccentric and subtracting the least distance from the greatest. 3. Will it make any difference with the throw of the eccentric, or travel of the valve, if ⅛″ is turned off the eccentric all around? *A.*—No.

(131) G. H. C., Rockport; Ill., writes: In a description of the famous Westminster clock it is stated that the movement is so accurate as not to vary more than two or three seconds per month. What I want to know is, how the power is maintained when the clock is being wound up. It seems that I have heard that there is something for this purpose. *A.*—In all of the better class of clocks there is what is technically called a *maintaining power*, for keeping the wheels in motion when being wound up. Exactly what this is in the clock mentioned we are unable to say.

(132) O. C., St. Paul, Minn., asks: What power will a leather belt, double thickness, transmit from a five-foot driving pulley to a four-foot pulley, the pulleys being 17 feet apart, and a tightener being used, so that the belt embraces one-half the circumference of the small pulley; revolutions of driving pulley, 80 per minute? *A.*—It would be impossible to tell what such a belt *would* drive, except by trial. We should say a good belt, with pulleys in good condition, *should* transmit from 40 to 50-horse power. It might be possible to transmit, for a short time, double this power.

(133) J. F. H., Mill Village, N. S., asks: 1. How can I determine how much weight a cask will support in fresh water? *A.*—By finding the difference between the weight of the cask and the weight of a quantity of water equal in bulk to the cask. 2. What does a cubic inch of fresh water weigh? *A.*—.0361253 lbs. 3. Does heating air take all the moisture from it? *A.*—Not necessarily. 4. We are driving a shaft by means of a water-wheel. Can we connect an engine to the same shaft so that it can be stopped without stopping the wheel? *A.*—You can connect by a frictional clutch.

(134) D., Denver, Col., asks: 1. Why are the holes in the rock-arms of some locomotives thrown out of line, and what is the rule for obtaining the correct distance? *A.*—It is because the valve seat and central line of motion of the link motion are not in the same plane. The lower end of the rocker should be at right angles with the central line of motion of the link motion, and the upper end at right angles with the motion of the valve, with the valve at mid travel. 2, What effect will it have on the valve motion if the lifting arms are set out of plumb with the rocker arms? *A.*—It will bring about modifications of the motion of the valves, corresponding with the location of the lifting arms, their length, etc. 3. Where can I buy a work treating on the valve motion used by Mason on narrow gauge locomotives built by him? *A.*—Mr. Mason is an authority on link and valve motion, but we are not aware that he or any one else has published anything relating to the valve motion of these engines.

(135) W. L. F., St. Louis, Mo., sends sketch of an oblong disc 3″×4″, about 2″ thick, The hole is out of the center, but the part nearest the center is made enough thicker to exactly balance when on an arbor. He asks: 1. If this would run without shaking at 1,000 revolutions per minute? *A.*—If the metal is evenly distributed on each side of a line through the disc at right angles to the axis, it will run without shaking. 2. How can I bend steam pipe short without flattening it? *A.*—It is difficult to do this without flattening the pipe somewhat. You may accomplish what you want to by filling the pipe with moulding sand, heating and bending by prying around pins, or better still between formers cut out to the round of the pipe.

BUSINESS SPECIALS.

Transient Advertisements, 50 cts. a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Steel Name Stamps, &c. J. B. Roney, Lynn, Mass.

Portable Forges, $10. Holt M'f'g Co., Cleveland, O.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N.J

James W. See, Consulting Engineer, Hamilton, O.

Lyman's Decimal Table. Price 10c. Address, Edward Lyman, C. E., New Haven, Conn.

Mechanical Engineer. Complete motive power outfits a specialty. Peter Banta, Cold Spring, N. Y.

Latest and best books on Steam Engineering. Send stamp for Catalogue. F. Keppy, Bridgeport, Ct.

Machine designing and general engineering work, T. J. Winans, 54 M. & E. R. R. Av., Newark, N. J.

Currier & Snyder's Improved Upright Drill. Send for cut and price. Worcester, Mass.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

In stock.—16″ speed lathes of superior design, from new patterns.—Fay & Scott, Dexter, Me.

W. F. Merrill, 27 Kilby Street, Boston, Mass. Detailed Mechanical Drawings carefully prepared.

Wood Engraving done in best manner. Designs furnished. Edward Sears, 48 Beekman St. New York

Foot Power Machinery, for workshop use, sent on trial if desired. W.F. & John Barnes, Rockford, Ill.

Pattern and Brand Letters. Vanderburgh, Wells & Co., corner Fulton and Dutch streets, New York.

For sale, 25″ lathes of best designs from new patterns. George A. Ohl & Co., E. Newark, N. J.

Chas. T. Porter, Mechanical Engineer, Tribune Building, (Room 42,) New York City.

Universal grinders for lathe-centers, chucks, angles or cylinders. C.C. Hill, room 8, Uhlich Block, Chicago

For a strictly first-class automatic engine of from ten to sixty horse-power, address, The Straight Line Engine Co., Syracuse, N. Y.

Weller & Herzig, Model Makers, Light Machinery Patterns, etc. 1685 North 3rd Ave., cor. 173d St., New York City. Corespondence solicited.

Pond planer, planes 5′x24″x24″, to be replaced by 8′ same make, now in use and for sale by Am. Twist Drill Co., Meredith, N. H.

Boiler Scale.—Parties having fine specimens for sale or loan, for exhibition, address Jas. F. Hotchkiss, 84 John street, New York.

Pattern Maker's Assistant. By Joshua Rose. 324 pages, $2.50 by mail, postpaid. Address orders, P. O. box 3,306, New York City.

A handsome monthly journal sent free to engineers and mechanics. Enclose four 3-cent stamps for year's postage and receive paper. Money Saver, 95 Liberty street, N. Y.

"Patent Binder" for the AMERICAN MACHINIST holds 52 weekly issues in good shape. Sent to any address by mail for one dollar. American Machinist Publishing Co., 96 Fulton street, New York.

Free—"Useful Hints on Steam." A book of 96 pages, illustrated. Valuable to engineers, steam users and those about purchasing steam machinery. By mail, 15 cents, or free on personal application. E. E. Roberts, 107 Liberty St., New York City.

The *Electrical Review*, an illustrated weekly journal of electric light, telephone and telegraph news. Subscription, only $3 per annum, to any part of the United States and Canada, postage prepaid by the publishers. Delano and Company, 23 Park Row, New York. Box 3329.

Chordal's Letters.—John Wiley & Sons, 15 Astor Place, New York, have now ready a new and enlarged edition, with six additional plates, of Chordal's Letters, comprising the choicest selections from the series of articles entitled "Extracts from Chordal's Letters," which have appeared in the columns of the AMERICAN MACHINIST; with a steel portrait of the author, and upwards of fifty original illustrations by Chas. J. Taylor. One volume 12 mo. of nearly 400 pages, cloth, $2.00. Will be mailed and prepaid on the receipt of the price.

Now ready for delivery, volume 5 of the AMERICAN MACHINIST, comprising the year 1882, (52 issues) complete with index, in substantial book form. Also a few remaining of volumes 3 and 4 comprising the years 1880 and 1881, can be sent anywhere by express. Price of each volume, $4.00; express charges to follow. AMERICAN MACHINIST Publishing Company, 96 Fulton street, New York City.

The following letter from a well-known dealer in building materials will explain itself:

AKRON, O., Feb. 24, 1883.

MR. ——: In reply to your request to give you my opinion of H. W. Johns' Paints, I take pleasure in stating that I have been handling these paints for nearly eight years, keeping them on sale in all the different shades and using them in my building business, and I have no hesitancy in saying I believe them to be the cheapest and best paints in use, not excepting pure lead and oil.

They are cheaper, because they will spread over more surface and cover better. I know to a certainty that two coats will cover better and last longer than three of any other paint, and it will outwear and retain its lustre and color better than any other. I have tried many kinds of paint and had concluded before using these that pure lead and oil was the only reliable paint, but after years of experience I am entirely satisfied that these paints are much better and more economical to use. D. W. THOMAS. ***

MANUFACTURES.

The work on the new foundry of the Phœnix Iron Works, Meadville, Pa., is well under way.

Wilson & Rogers, St. Paul, Minn., have added the sale of machinery and machinists' supplies to their business.

A Boston capitalist has offered $50,000 provided $75,000 is raised in Rome, Ga., for a new cotton factory in that city.

Cook, Son & Co., have started a machine shop in Kansas City, Mo. They are looking about to purchase a first rate shafting lathe.

There is prospect, says the Cleveland *Trade Review*, of starting the manufacture of the "Universal Gas Engine," an English invention, in this city.

The citizens of Mercer, Pa., have raised $10,000, the amount required to have the tube works of J. M. Downing removed there from New Castle.

David Shortsleeve & Co., Rutland, Vt., will soon enlarge their machine shop to twice its present size and increase the force of workmen employed.

Williams, White & Co., of Moline, Ill., are getting out a new machine for pressing the skeins upon the axles of wagons and the boxes into the wheels.

The Freeport, Ill., Malleable Iron Works have been leased for five years to a wealthy capitalist, and F. S. Taggart, a well-known machinist and inventor.

Whitney & Marshall, 22 Tremont street, San Francisco, Cal., have taken the special agency for the machine tools of E. Gould & Eberhardt, Newark, N. J.

Thorne, De Haven & Co., builders of machine tools, Philadelphia, Pa., have disposed of their business to Thomas H. Dallett, who will continue it under his own name.

H. L. Shepard & Co., Cincinnati, O., have recently sold one of their lathes to the Canadian Government, also twelve to go to China, and other foreign countries.

The Iron and Steel Works Association of Va., intend to blow in their blast furnace at Victoria near Goshen, Va., before April 1st. It is expected to make 330 to 360 tons of pig iron per day.

Lawrence & Herkner, 8 Ferry street, New York, have furnished to the capital building, Albany, N. Y., a 50-inch wide double belt, sixty-five feet long, for driving the electric light machinery.

Perkins & Co., Grand Rapids, Mich., have been so pushed with orders for shingle machinery and other specialties that they have put up a new shop building, and added a considerable number of tools.

The citizens of Duncannon, Perry Co., Pa., have donated three acres of ground and $1,500 in money to S. T. Sankey & Co. of Millheim, Center Co., as an inducement to have them locate their agricultural works there.

The Abel Machine Co. has been formed at Laconia, N. H., with $100,000 capital for the manufacture of all kinds of knitting machinery. Henry W. Boardman is President and Hiram Hodgdon Secretary and Treasurer.

Richard Dudgeon, 24 Columbia st., New York, is running his shop 12½ hours a day with full force. This has been the case for 15 months, and there is no diminution of orders for his hydraulic jacks, and boiler tube expanders.

The Williams Manufacturing Company, of New Bedford, Mass., has been incorporated with a capital of $200,000 for the manufacture and sale of iron, steel and other metals, Edmund Grinnell, president; Samuel Ivers, treasurer.

Through their London branch house, H. Prentiss & Co., of New York, are prepared to place American machinery, small tools and novelties upon the English and Continental markets, also to purchase English machinery for delivery here.

R. H. Brown & Co., Westville, Conn., have bought from C. H. Reed, Danbury, Conn., the patents of his drill chuck. They will manufacture the chuck entirely of steel with parts interchangeable. The pattern will also be somewhat changed.

Durkee & Keffer will take possession of their new works, at the southwest corner of West Monroe and Clinton streets, April 1, and place in them $5,000 worth of new machinery. They will also double their present capacity.—*Chicago Industrial World.*

The Pacolet Manufacturing Company of Pacolet, S. C., is building a new cotton mill at Trough Shoals on the Pacolet River. At this point the supply of water is abundant, the two falls being considered capable of furnishing the necessary power for 50,000 spindles.

The Pittsburg, Cincinnati and St. Louis Railroad intends erecting shops at Columbus, Ohio, in the spring, with a capacity for building fifty engines, thirty-six passenger, and three thousand freight cars per year. The estimated cost of the shops and connecting tracks is $537,000.

Sweetland & Co., New Haven, Conn., have made no personal solicitation for orders for their chuck in the West for two years until last month. Upon visiting a number of their Western customers they have booked orders for several weeks ahead for their entire product.

Grading the grounds for the new shops of the Pennsylvania Company, at Fort Wayne, Ind., has been going on regardless of the weather. The buildings will be of brick and the shops will afford employment for 1,000 men.

Blast furnace proprietors of New Castle, Pa., have posted the following schedule of wages in their works, taking effect from March 4th, 1883:

Keepers from	$2.50 to $2.25 per day.
Helpers from	2.00 to 1.75 per day.
Top fillers from	2.25 to 2.00 per day.
Bottom fillers from	2.00 to 1.75 per day.
Hot blast men from	2.00 to 1.75 per day.
Laborers from	1.40 to 1.25 per day.

The H. W. Johns Mfg. Co., 87 Maiden Lane, New York, manufacturers of asbestos packing and covering for all purposes, have recently made improvements in the manufacture of rod packing for steam, water, &c., by which its efficiency and durability is materially increased. These improvements consist in the arrangement of the fiber to give the packing a greater degree of elasticity, and at the same time to prevent its disintegration when in use.

The Southern Manufacturer & Builder, says: There is a great deal of old worn out machinery in the South that must be replaced by new machinery. The people have held on to their old machinery as long as it will stand the demands upon it, and now finding it thoroughly worn out, they are driven to the necessity of replacing it. All through the South there is a need for new machinery, and this need must be met. These people with large crops for two years, have money to gratify their wants, and are only looking for the opportunity.

Forbes & Curtis, Bridgeport, Conn. began Manufacturing Forbes' patent die stocks in that city in January last, and have now 16 men employed. Their shop is 30x70 ft. and equipped with new tools throughout, many being specially designed for their work. They are meeting with gratifying success. This die stock was illustrated in the October 21st, 1883, issue of the AMERICAN MACHINIST, and orders thus far received are from such important establishments as the shops of the Penn. R. R., United Pipe Lines and others, together with several export orders.

The Jarvis Furnace Company, Boston, Mass., have been setting a number of their furnaces under steam boilers in the West Indies to burn wet bagasse, or sugar-cane trash, without drying. Their system has proved successful and they have received this week orders for a large amount of work to commence when the present crop is completed. Among the sugar estates that are now using these furnaces are the Yugo Matilde, of Don Jose, N. Baro, Yugo Santa Barbara, of Don Napoleon Davis, Yugo El Senedo, of Heyos de Sanchetz Dolz. This company have orders to start work on the islands of Santo Domingo, Porto Rico, Sandwich Islands, British Honduras and Java.

The annual meeting of stockholders of the Tewksbury Automatic Elevator Company, New York City, was held Feb. 21st. when the following directors were elected: Hon. F. M. Madden, Hon. L. A. Osborn, William Millspaugh, H. H. Bowman, L. F. Hover, Thomas King and Geo. C. Tewksbury. The officers elected are: President, Hon. F. M. Madden; Secretary and Treasurer, L. F. Hover. The company's business is reported as increasing and their elevators giving good satisfaction. The company are making plans to build a large factory, which will be fitted up first-class in every particular. The machine shop, to be built of brick, will be about 35×300 feet and will be ready to occupy July 1st.

For the purpose of extending the workshops of the Institute of Technology, the corporation of that institution has secured a lot of land on the Boston & Providence Railroad, near St. James avenue, Boston, and the work of erecting buildings thereon will be begun at an early day. The new shops, which will cover an area of 18,000 square feet, will be on an extensive scale. In the present shops a class of sixteen is the largest that can be accommodated at one time, but in the proposed building a class of thirty-two pupils will be able to receive instruction. The buildings will, probably, be two stories high, and will contain a large amount of new machinery. Boiler riveting, brazing and soldering will be new departments. A building committee has the matter in hand, and the second-year class in mechanical engineering is to make several excursions to the Amory Mills at Manchester to get full drawings of buildings and machinery.—*Manufacturers' Gazette.*

James. F. Hotchkiss, 84 John, street New York, has just issued the Eighth edition of his little book entitled "How to Keep Boilers Clean." The book alluded to contains a general and detailed description of the Hotchkiss mechanical boiler cleaner, together with recommendations of how to attach it to the various forms of boilers now in use including locomotives. Various improvements in the mechanical details of construction made in the construction of this boiler cleaner are described. Such improvements having been made since the first introduction of the apparatus in 1875, the general principles remaining unchanged. In addition to these illustrated descriptions this book contains much general information in regard to the selection, care and management of steam boilers. Besides these there are given numerous mechanical receipts and tables of value to steam users and engineers. This little book is published by the author, who distributes it gratis to all parties favoring him with their address.

Machinists' and Engineers' Supplies.

New York, March 22, 1883.

Trade in small supplies fluctuates somewhat, which is owing largely to the unsettled weather. It is generally believed, however, that with settled weather will come an increase of business. There are no changes in prices worthy of notice.

Sweetland & Co., New Haven, Conn., have entered into contract to market the Reid Chucks made by R. H. Brown & Co., of Westville, Conn.

James Beggs & Co., 9 Dey street, New York, have just placed upon the market a new toolholder to be used by carpenters and other mechanics for holding plane irons and other similar tools at any desired angle against the face of a grindstone. The handle contains a reservoir for water.

Iron and Metal Review.

There seems to be an impression with some that there will be a still further decline in prices before business revives upon a solid basis.

We quote prices as follows: Foundry, No. 1, $24 to $24.50. Foundry, No. 2, X $21.50 to $22.50. Grey Forge, $18.50 to $19.50.

Foreign Iron continues dull and prices weak. We quote Langloan at $24 to $24.50. Coltness $24 to $24.50. Glengarnock, $22 to $22.50. Gartsherrie, $24 to $24.50. Summerlee, $24 to $24.50. Carnbroe, $22. Eglinton, $21 to $21.50

The demand for Wrought Iron Scrap continues light at $26.50 for prime selected from yard, and $25 for ex-ship.

Copper continues quiet at 17⅝c. to 17¾c. Banca Tin 22¾. to 22¼c.; Straits and Malacca, 22⅛c. to 22¼c; Australian and Billiton, 22⅜c.; English Refined 22¼c.; Spelter, Common Domestic, 4.65c. to 4¾c.; Refined 8c. to 8¼c.; Lead 4.70c. to 4.75c.;

WANTED

"Situation and Help" Advertisements, 30 cents for each seven words (one line) each insertion. Copy should be sent to reach us not later than Thursday morning for the ensuing week's issue.

Wanted—A competent salesman for a well known first-class steam engine. Address, with reference, B., this office.

A mechanical engineer, now superintendent, desires a position as draughtsman, superintendent or manager. Address, M., American Machinist office.

Wanted—A situation as Draughtsman or Foreman. Special attention to machine tools. Address, J. B., American Machinist.

Wanted—A middle-aged active and first-class machinist, who is capable of taking charge of the fitting department in building machine tools Address the Universal Radial Drill Co., Cincinnati, O.

Mechanical Draughtsman experienced in sewing machine work, electrical machinery, &c., having excellent references from first-class houses, desires a position near the city. Address, D., Box 1. American Machinist.

Wanted—Machinists. Strictly first-class vise hands and fitters. Experienced men, accustomed to machine tool work, can obtain steady employment at liberal wages. Address, Niles Tool Works, Hamilton, Ohio.

Wanted - A foreman who has been accustomed to engine and steam pump work, must be sober, industrious, a good workman and capable of managing from 20 to 50 men. Address, with references, stating terms, Engine and Steam Pump, care Am. Machinist, New York.

Draughtsman of theoretical knowledge, and long practical experience in the construction of marine and stationary engines, sugar plantation machinery and general mill work, is open for engagement; will go anywhere for a reasonable salary, where engineering is wanted Address, Draughtsman, care American Machinist.

Wanted—A situation as foreman, by a pattern-maker of sixteen years' experience, who has a thorough knowledge of engine work and steam pumping machinery. Has had four years' experience as foreman. Best of references given. Address, R., P. O. Box 1151, Ansonia, Conn.

Light and fine interchangeable machinery to order. Foot and power lathes; slide rests, &c. Catalogue for stamp. Edwd. O. Chase, Newark, N. J.

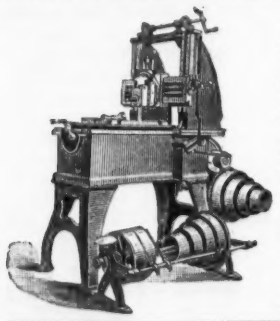
WORCESTER MACHINE SCREW CO.

AND 111 LIBERTY ST. NEW YORK

MANUFACTURERS OF

STANDARD MACHINE SCREWS.

IMPROVED CRANK PLANER



Planes 16 inches high and wide, and has 12 inch stroke. It has power, cross and angular down feed as shown in cut, or cross feed only, if desired. Also, quick return motion and screw running whole length under bed. It is self-oiling in its ways.

R. A. BELDEN & CO.

Danbury, Conn.

FOR SALE.

We have the following second-hand Machinery for sale, viz.:

One Iron Planer, to plane 24 feet long, 62 in. x 62 in. square. It is powerfully geared, heavy and in good order.

One Iron Planer, to plane 12 feet long, 36 in. x 32 in. in fair condition.

One Iron Planer, to plane 12 feet long, 30 in. x 30 in.

One Pit Lathe face plate 6 feet dia., with internal wheel full dia., external wheel 38 in. dia., quadruple geared, will turn 10 feet dia. and 22 in. face in pit, swing 60 in. over ways, 48 in. over carriage, 21 ft. 6 in. between centers. All complete.

One Engine Lathe, will take 14 feet between centers, and swing 53 in over ways, has hollow spindle, and is adapted for both turning and boring, with countershaft. Complete.

One Engine Lathe, will take in 11 feet, 6 inches between centers, swings 48 inches over shears, and 32 inches over carriage. It has internal gear, and cross-feed, with countershaft. All complete.

One Slotting Machine, 12 in. stroke, slots to the center of 46 in. Adjustable table and universal feed motion.

One Combined Power Punch and Shears, to punch ⅝ and ½, and shear ½ in. iron.

One Axle Lathe, Fitchburgh Machine Co.

One 13 in. Shaper, Lowell Machine Shop.

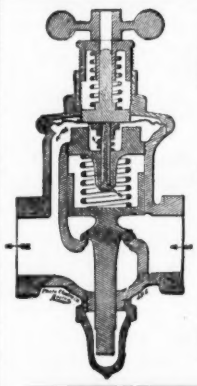
One No. 1 Brown & Sharp Screw Machine.

Two 4 in Spindle Drills.

One Pond's double Miller.

The George Place Machinery Co.,

121 CHAMBERS AND 103 READE STREETS, NEW YORK.



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Pressure Regulator

For Steam, Water and Air,

MANUFACTURED BY

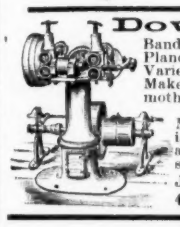
Curtis Regulator Co.

51 BEVERLY ST.,

Boston, - - Mass.

General Agencies:

109 Liberty St., New York.
925 Market St., Phila., Pa.
80 Market St., Chicago, Ill.
Cor. Holliday and Saratoga Streets, Baltimore.



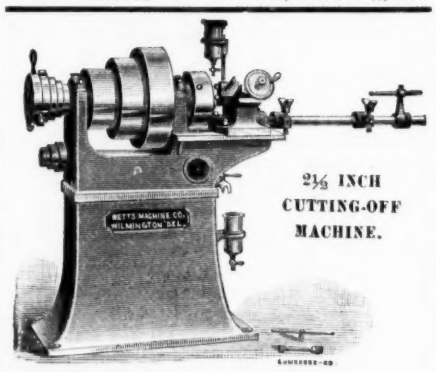
Dowel Machines

Band Saws, Rotary and Stationary Bed Planers, and Buzz Planers, Jig Saws, Variety Moulding Machines, Pattern Makers' Lathe, Boring Machines, Waymoth Lathes.

Also, a large stock of Second-hand Machinery, consisting of Machinists' Tools, Woodworking Machinery and Engines and Boilers. Send stamp for new illustrated catalogue.

Just out. ROLLSTONE MACHINE CO.

45 Water St., Fitchburg, Mass.



2½ INCH CUTTING-OFF MACHINE.

BETTS MACHINE CO.

Machine Tool Builders,

Wilmington, Del.

Buffalo Cupola & Forge Blowers.

Warranted superior to any other make.

All sizes and styles for every class of work.

BUFFALO FORGE CO.

BUFFALO, N.Y.

Send for Catalogue and prices.

ESTABLISHED 1851.

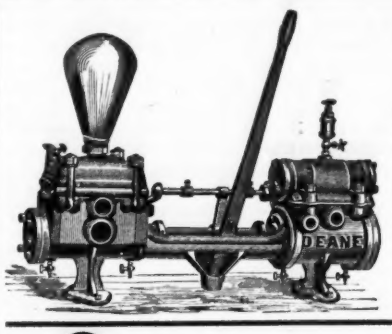
WM. B. BEMENT & SON,

PHILADELPHIA,

MANUFACTURERS OF

Lathes from 12 in. to 120 in. swing.
Planers from 20 in. to 120 in. width, and of any desired length.
Single and Double Shapers from 9 in. to 21 in. stroke.
Slotters from 6 in. to 30 in. stroke.
Vertical Drills from 24 in. to 60 in. swing.
Radial Drills from 48 in. to 144 in. radius.
Horizontal Boring Machines, three sizes.
Vertical Boring and Turning Machines from 4 ft. to 16 ft. diameter.
Punching & Shearing Machines, 20 sizes.
Bending Rolls, 6 sizes.
Steam & Hydraulic Riveters, several sizes.
Steam Hammers from 350 lbs. to 17 tons.

And a great variety of other tools, general and special.



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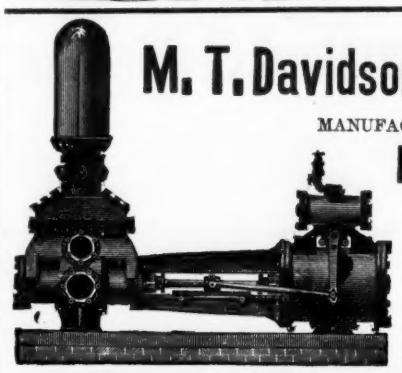
Steam Pumps for Every Service.

Send for New Illustrated Catalogue.

THE DEANE STEAM PUMP CO.,

HOLYOKE, MASS.

92 & 94 Liberty St., NEW YORK. 54 Oliver St., BOSTON. 226 & 228 Lake St., CHICAGO.



THE

M. T. Davidson Improved Steam Pump,

MANUFACTURED BY

Davidson Steam Pump Co.,

OFFICE & WORKS:

41 to 47 KEAP STREET, BROOKLYN, N. Y.

Warranted the Best Pump made for all Situations.

KELLY & LUDWIG, Agents,

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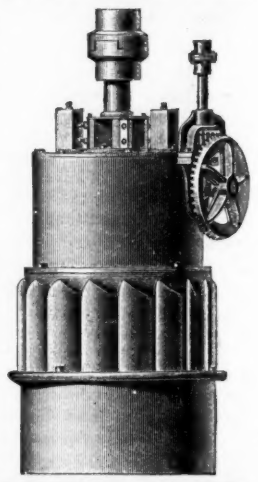

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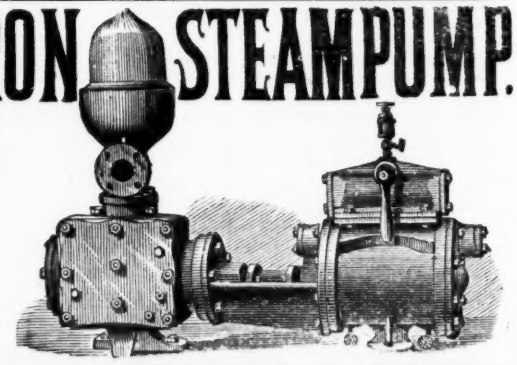

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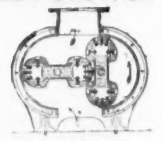

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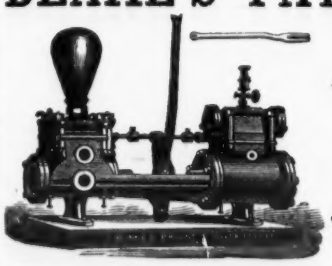

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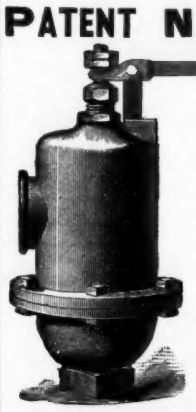

PITTSBURGH, April 10th, 1882.

C. A. MOORE, Esq., Prest. Consolidated Safety Valve. Co.
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Dear Sir:—In reply to your favor of the 7th inst., we would state that in October, 1874, we placed upon our boilers your 3-inch Nickel Seated Pop Safety Valves, which have always done their work satisfactorily, relieving the boilers instantaneously when the steam pressure reached the blowing off point, viz., 80 lbs. We have also furnished your valves to a number of our customers who have been well pleased therewith. The best evidence of which is the fact that after once using your valve they adopted them for their subsequent requirements. Yours truly,
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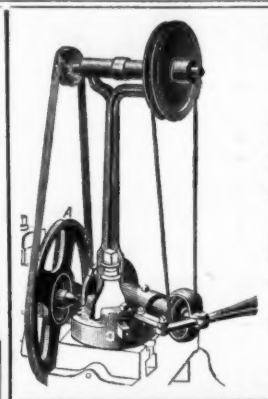
Dear Sir:—Replying to your letter of the 7th inst. It is now about twelve years since we commenced to use and recommend to others, "Nickel Seated Pop Safety Valve." From practical experience we have no hesitation in saying that it is the only Safety Valve in use, which can, under all circumstances, be relied upon. Yours truly, WILLIAM TOD & CO.



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With Steel Screws. Lathe Made and Hardened.

This dog is very heavy, and is warranted not to break with any work

No. 1	3-8 in.		$ .50
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" 7	1 1-8 "		.95
" 8	1 1-4 "		.95
" 9	1 3-8 "		1.10
" 10	1 1-2 "		1.10
" 11	1 3-4 "		1.25
" 12	2 "		1.40
" 13	2 1-4 "		1.60
" 14	2 1-2 "		1.60
" 15	3 "		1.80
" 16	3 1-2 "		2.00
" 17	4 "		2.30
" 18	4 1-2 "		3.00
" 19	5 "		3.50

Full set, 19 Dogs, 26.35

No. 20	5 1-2 in.		4.25
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Small set of 8 dogs from 3-8 to 2 ins., $7.30.

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Set of 12 from 5-8 to 4 inches, $15.00.

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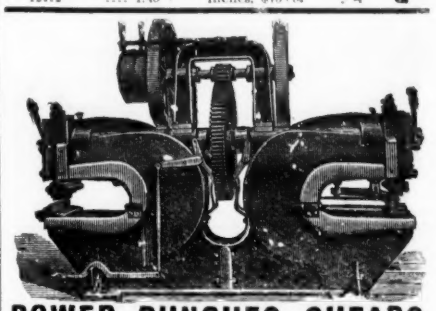

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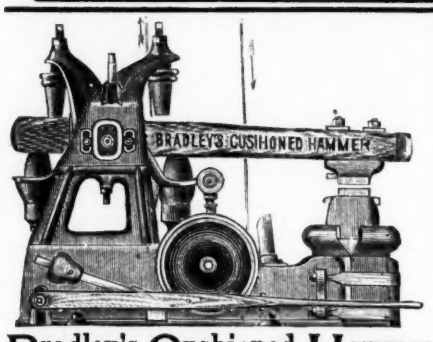

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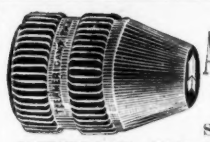

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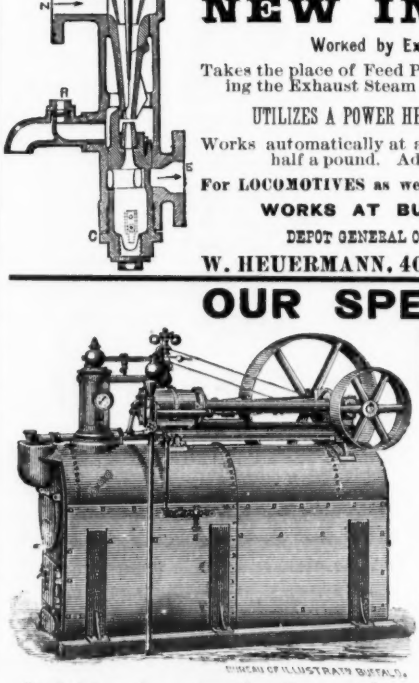

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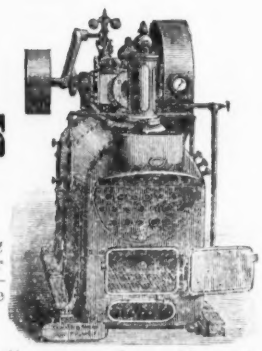

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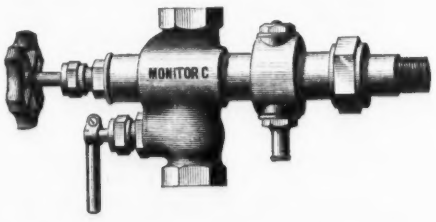

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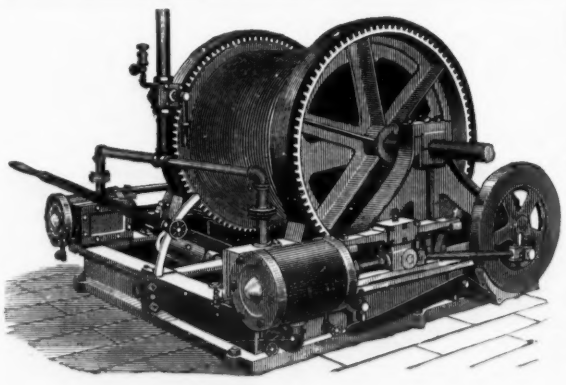

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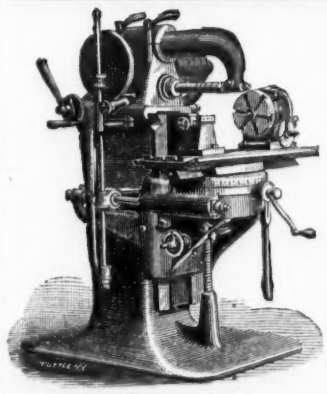

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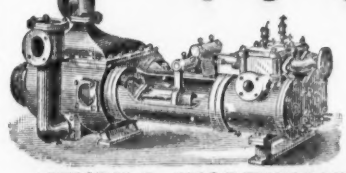

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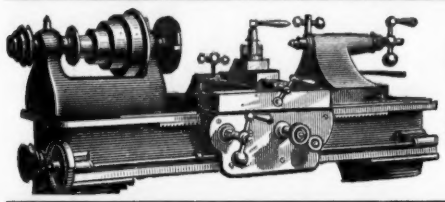

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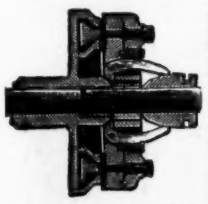

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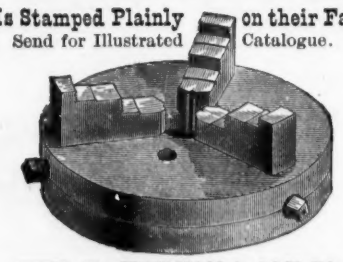

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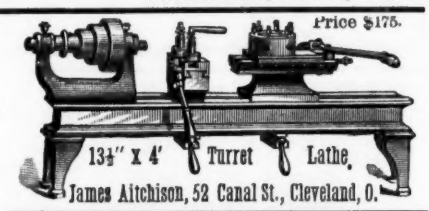

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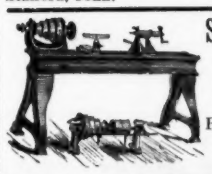

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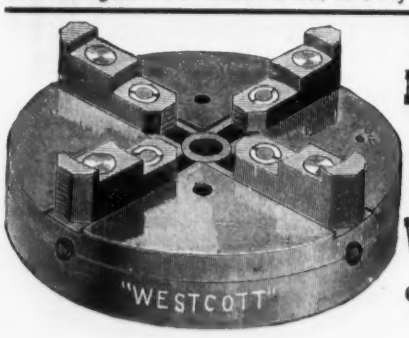

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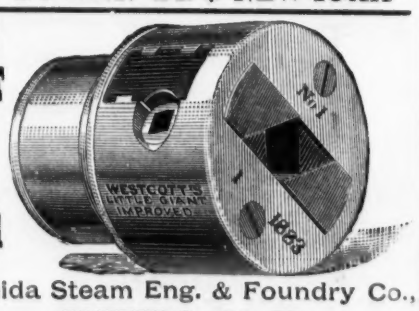

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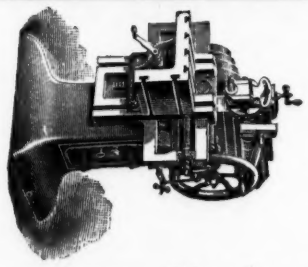

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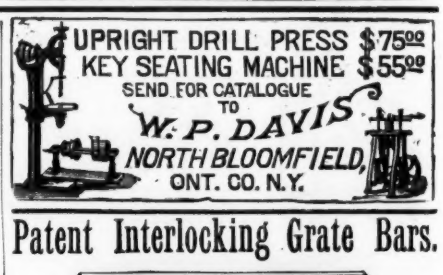

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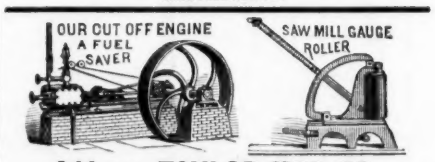

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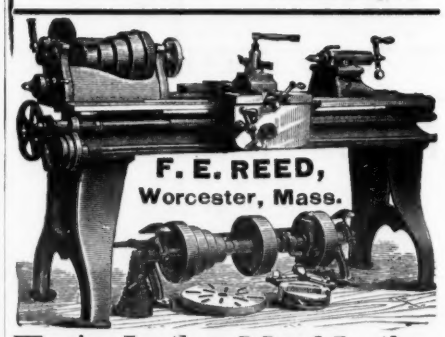

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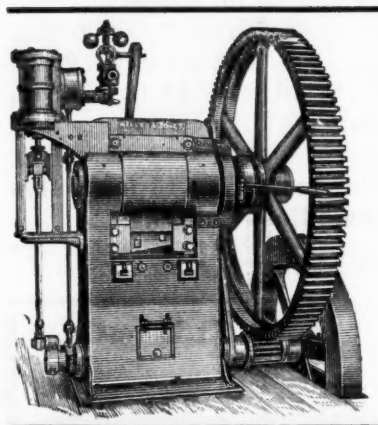

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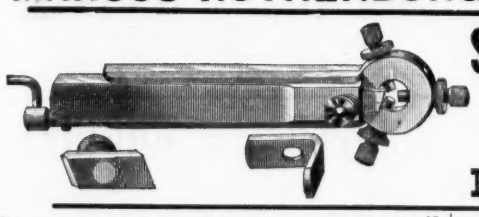

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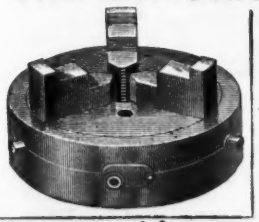

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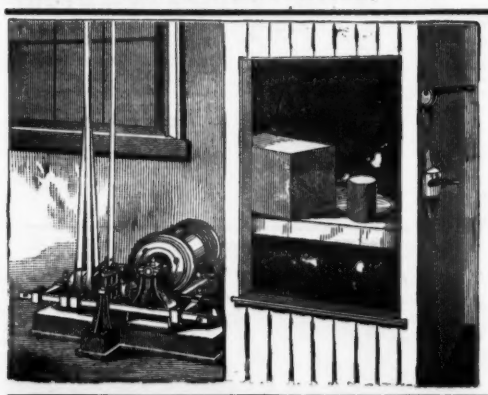

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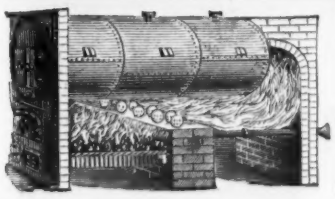

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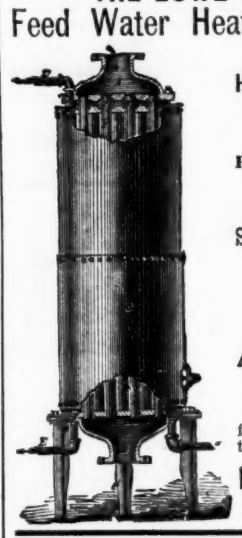

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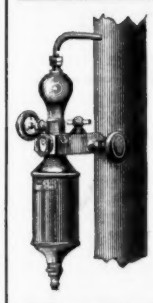

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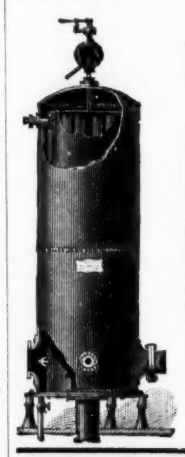

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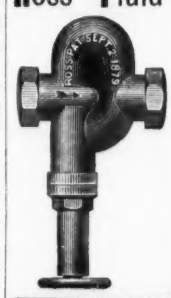

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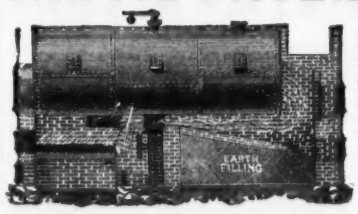

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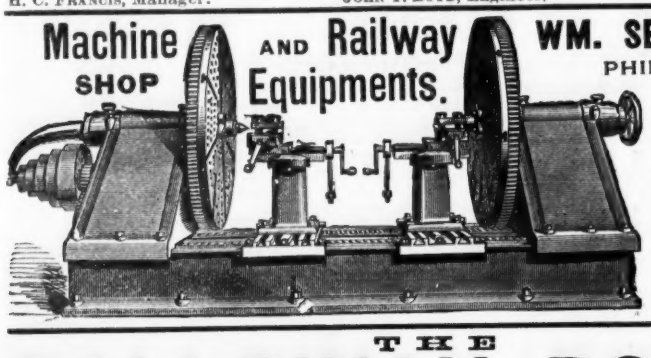

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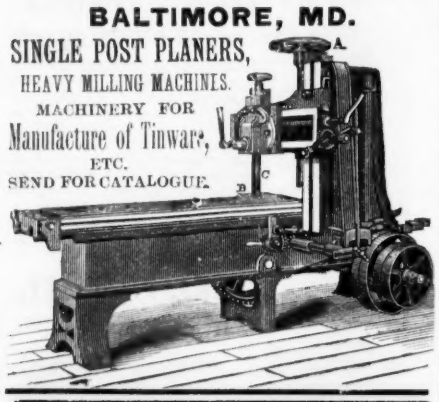

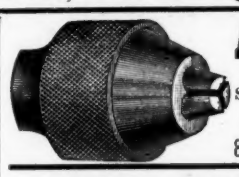

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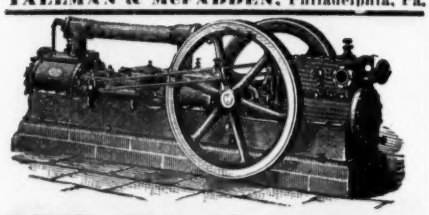

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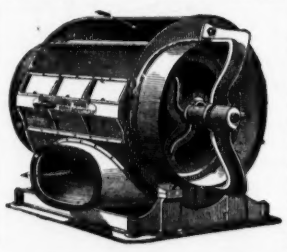

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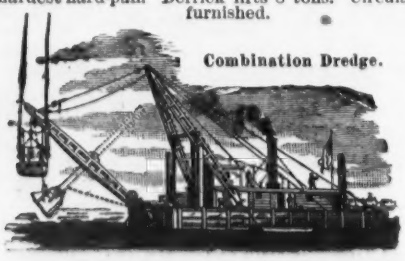

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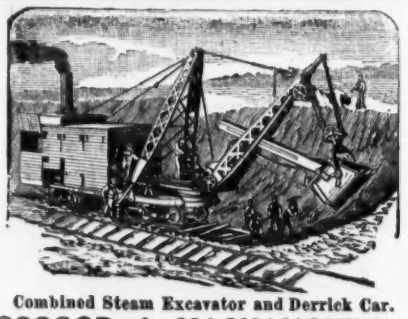

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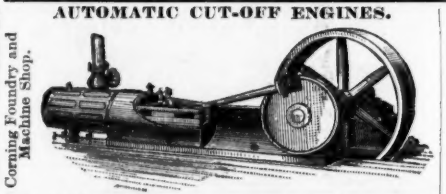

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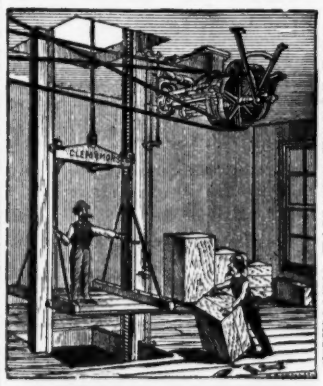

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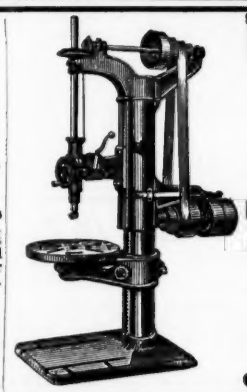

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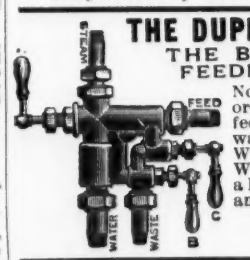

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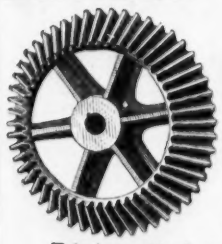

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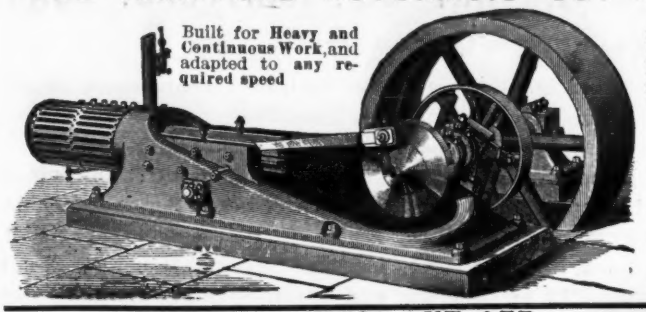

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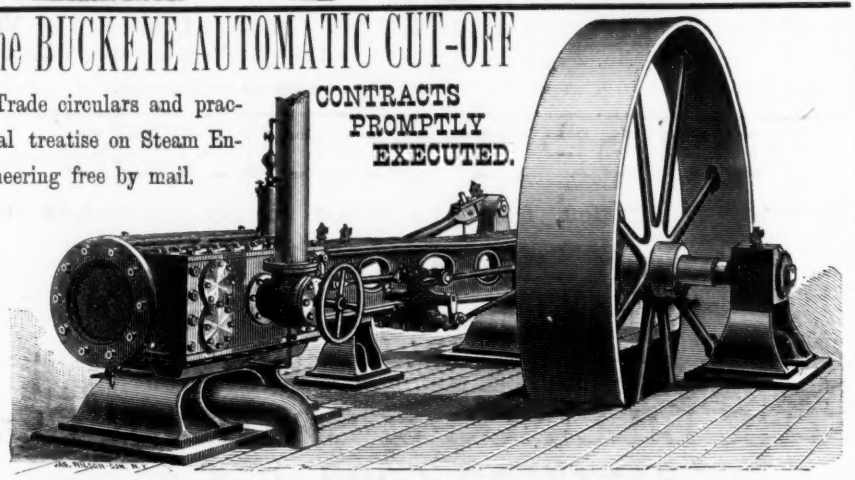

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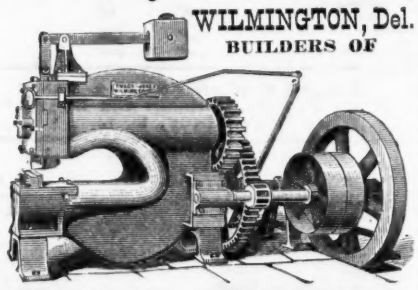

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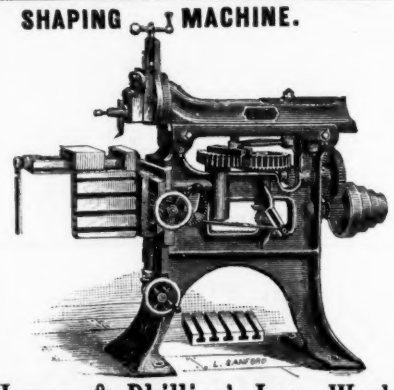

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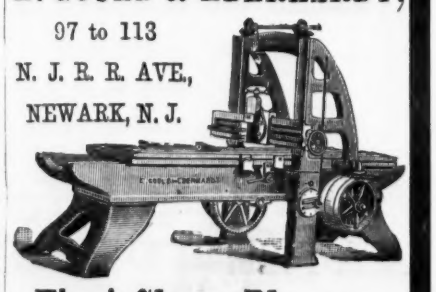

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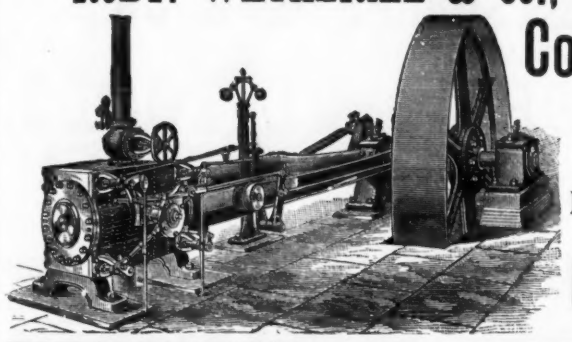

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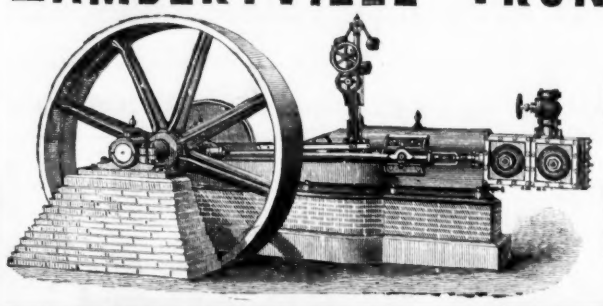

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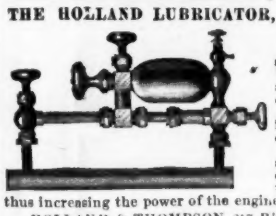

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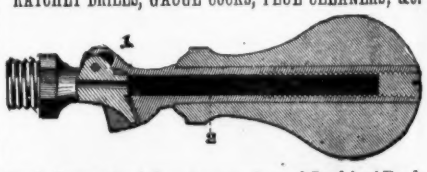

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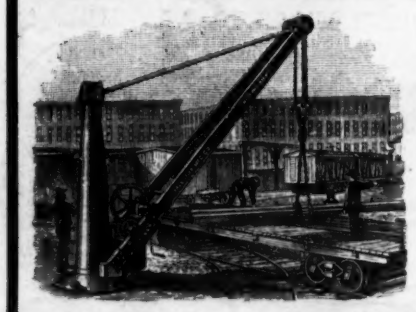

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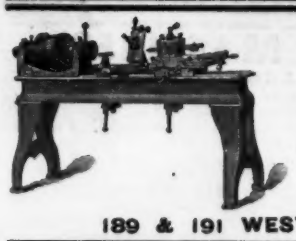

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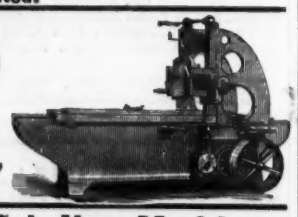

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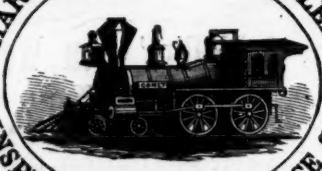

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